DOCUMENT RESUME

ED 244 833 SE 044 558

AUTHOR Stearner, Phyllis
TITLE Able Scientists--Disabled Persons. Biographical Sketches Illustrating Careers in the Sciences for Able Disabled Students.
INSTITUTION Foundation for Science and the Handicapped, Inc., Clarendon Hills, IL.
REPORT NO ISBN-0-916655-00-8
PUB DATE 84
NOTE 72p.
AVAILABLE FROM Foundation for Science and the Handicapped, Inc., 154 Juliet Court, Clarendon Hills, IL 60514 ($12.95).
PUB TYPE Books (010) -- Reports - Descriptive (141)

EDRS PRICE MF01 Plus Postage. PC Not Available from EDRS.
DESCRIPTORS *Biographies; Elementary School Science; Elementary Secondary Education; *Employment Opportunities; Engineers; *Physical Disabilities; *Science Careers; *Scientists; *Secondary School Science

ABSTRACT

This book describes the lives and achievements of 27 disabled scientists and students of science who are overcoming obstacles and are carrying on careers and studies in their chosen field of science or engineering, graphically showing that individuals with physical disabilities can succeed in scientific and technical work. The book presents a sample cross section from a large group of successful scientists with a wide range of disabilities, describing, among others, a paraplegic electron microscopist, a world renowned expert on transplantation biology who is deaf, and a blind computer scientist. Disabled students profiled range from those about to receive their bachelor's degrees to doctoral candidates. Their disabilities range from congenital encephalopathy to cerebral palsy, and from congenital glaucoma to spinal bifida. The major objectives of the book are to illustrate possible career options open to physically disabled students and to encourage teachers and counselors (especially those in elementary and junior high schools) to help scientifically talented disabled students to get the education they need to prepare them for scientific careers. (JN)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

U.S. DEPARTMENT OF EDUCATION
NATIONAL INSTITUTE OF EDUCATION
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

This document has been reproduced as received from the person or organization originating it.

Minor changes have been made to improve reproduction quality.

Points of view or opinions stated in this document do not necessarily represent official NIE position or policy.

ED244833

ABLE SCIENTISTS-DISABLED PERSONS

CAREERS IN THE SCIENCES

BY S. PHYLLIS STEARNER, Ph.D.

SE044558

"PERMISSION TO REPRODUCE THIS MATERIAL IN MICROFICHE ONLY HAS BEEN GRANTED BY

Phyllis Stearner

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

ABLE SCIENTISTS–DISABLED PERSONS

BIOGRAPHICAL SKETCHES ILLUSTRATING CAREERS IN THE SCIENCES FOR ABLE DISABLED STUDENTS

BY S. PHYLLIS STEARNER, Ph.D.
with a Foreword by Martha Ross Redden

JOHN RACILA ASSOCIATES, INC., OAKBROOK, ILLINOIS

Published for the
FOUNDATION FOR SCIENCE AND THE HANDICAPPED, INC.
By John Racila Associates, Inc.
2820 Oak Brook Road
Oak Brook, Illinois 60521

©1984 by S. Phyllis Stearner, Ph.D.
All rights reserved.

Illustration on Dedication Page drawn by Marcia W. Rosenthal

Direct inquiries concerning this book
and its purchase ($12.95) to:
Foundation for Science and the Handicapped, Inc.
154 Juliet Court
Clarendon Hills, Illinois 60514
Phone: (312) 323-4181

Printed in the United States of America
First Edition—1984

Library of Congress Catalog Number: 84-60396

ISBN 0-916655-00-8

The bumblebee wings its way among the flowers on a warm summer day, despite aerodynamic principles proclaiming "it cannot be done." Unrecognized thousands of scientists who just happen to be disabled similarly go about daily activities that for them have been proclaimed impossible.

To these "able" disabled scientists, a few of whom are profiled here, this book is respectfully dedicated.

CONTENTS

viii ILLUSTRATIONS

xi FOREWORD — Martha Ross Redden

xiii ACKNOWLEDGMENTS

1 INTRODUCTION

3 BIOGRAPHICAL PROFILES:

4 Joseph R. LARSEN: Professor of Entomology, Director of School of Life Sciences; Mobility Impaired
6 John J. GAVIN: Molecular Biologist, Director of Research; Deaf, Mobility Impaired
8 Cynthia DUSEL-BACON: Geologist; Amputee
10 Herbert W. HOFFMAN: Meteorologist; Mobility Impaired
12 Donald L. BALLANTYNE: Professor of Experimental Surgery; Deaf
14 Edward C. KELLER, Jr.: Professor of Biology, Ecologist, Geneticist, Statistician; Mobility Impaired
17 Paul R. FILPUS: Computer Programmer; Blind
18 Nansie S. SHARPLESS: Neurochemist; Deaf
20 Lawrence WOS: Mathematician; Blind
22 Odette L. SHOTWELL: Organic Chemist; Mobility Impaired
24 Richard W. KUSH: Mechanical Engineer; Deaf
26 Robert P. LARSEN: Analytical Chemist; Mobility Impaired
The Lesson of Barney Miller — Robert P. Larsen
30 Anne B. SWANSON: Biochemist; Short Stature
32 Kirby L. MORGAN: Physicist, Computer Analyst; Mobility Impaired
34 Harvey L. LAUER: Rehabilitation Researcher, Educator; Blind
36 June M. ROOKS: Physicist; Mobility Impaired
38 Richard S. SKYER, Jr.: Biological Researcher, Educator of Deaf; Deaf
40 James A. HENRY: Systems Analyst; Mobility Impaired
42 Teddy L. BARBER: Optical and Atmospheric Physicist; Blind
44 Karen M. JACARUSO: Biologist, Educator of Deaf; Hearing Impaired
45 R. Kent JONES: Civil Engineer; Mobility Impaired
46 Todd A. BLUMENKOPF: Organic Chemist; Mobility Impaired
48 M. Dolores CIMINI: Clinical Psychologist; Blind
49 Lawrence G. HORKEY: Engineering Designer; Deaf
50 Martha A. BURKS: Student of Computer Science; Mobility Impaired
52 Robert A. REGAN: Medical Technologist; Learning Disabled
53 Herman H. M. MUI: Student of Electrical Engineering; Mobility Impaired

54 CONCLUDING COMMENTARY

56 SELECTED RESOURCES

58 ABOUT THE AUTHOR — Marcia W. Rosenthal

63 INDEX OF PROFILED INDIVIDUALS

65 FOUNDATION FOR SCIENCE AND THE HANDICAPPED, Inc.

ILLUSTRATIONS

4 Professor JOSEPH K. LARSEN, Sc.D. (parapiegic), uses an electron microscope in some of his studies of the morphology and physiology of the nervous system of arthropods.

7 JOHN J. GAVIN, Ph.D. (deaf), carries on telephone conversations as part of his administrative responsibilities as Director of Research.

8 CYNTHIA DUSEL-BACON, B.A. (arm amputee), a geologist in the United States Geological Service, uses a specially adapted microscope to study geologic characteristics of rock slices.

11 HERBERT W. HOFFMAN, M.S. (cerebral palsy), operates a microcomputer with his left foot to prepare weather reports.

13 Professor DONALD L. BALLANTYNE, Ph.D. (deaf), teaches techniques in experimental microsurgery, many of which he has developed.

14 Professor EDWARD C. KELLER, Jr., Ph.D. (postpolio), demonstrates a marine specimen to physically disabled high school students.

17 PAUL R. FILPUS, B.S. (blind), a computer programmer at Miles Laboratory, Elkhart, Indiana, makes use of electronic reading aids to facilitate processing of data.

19 NANSIE S. SHARPLESS, Ph.D. (deaf), is a neurochemist and Associate Professor at Albert Einstein College of Medicine.

20 LAWRENCE WOS, Ph.D. (blind), uses a Triformations LED-120 braille line printer and braille terminal in developing programs in automated reasoning at Argonne National Laboratory.

23 ODETTE L. SHOTWELL, Ph.D. (postpolio), an organic chemist at the Northern Regional Research Center, U.S. Department of Agriculture in Peoria, examines corn seeds for presence of aflotoxins.

24 RICHARD W. KUSH, B.S. (deaf), an Engineering Specialist at Argonne National Laboratory, works with reactor engineers on fabrication design.

27 ROBERT P. LARSEN, Ph.D. (postpolio), an analytical chemist at Argonne National Laboratory, uses a special stool which he designed to meet his needs in the laboratory.

30 ANNE B. SWANSON, Ph.D. (osteogenesis imperfecta), Associate Professor of Chemistry at Edgewood College in Madison, Wisconsin, uses an elevated platform with a railing and attached set of stairs to carry on her work in the laboratory.

33 From his bed, KIRBY L. MORGAN, M.S. (rheumatoid arthritis), can reach and see the keyboard and monitor of his computer, which is located on a special height, movable cart.

34 HARVEY L. LAUER, M.S. (blind), uses and tests tactile output devices with vibrating letter shapes.

37 JUNE M. ROOKS, B.S. (postpolio), a physicist at the Naval Weapons Center in China Lake, California, analyzes and develops software used in determination of aircraft performance.

38 RICHARD S. SKYER, Jr., M.S. (deaf), and his supervisor discuss radioimmunoassay procedures, with use of manual sign language and oral speech reading.

40 JAMES A. HENRY, B.A. (cerebral palsy), uses a computer terminal for programming, a part of his routine daily activities as a systems analyst.

42 TEDDY L. BARBER, M.S. (legally blind), a physicist at the White Sands Missile Range in New Mexico, processes scientific data through a large-screen computer terminal.

44 KAREN M. JACARUSO, B.S. (hearing impaired), uses a Coulter Counter platelet counter for peripheral blood studies on dogs.

45 R. KENT JONES, B.S. (multiple sclerosis), is a civil engineer with the Metropolitan Sanitary District of Greater Chicago.

47 TODD A. BLUMENKOPF, B.S. (spinal bifida), is a Ph.D. candidate majoring in organic chemistry at the University of California at Berkeley.

48 MARIA DOLORES CIMINI, B.A. (congenital glaucoma), is a Ph.D. candidate in clinical psychology at the State University of New York at Albany.

49 LAWRENCE G. HORKEY, A.A. (deaf), an engineering designer at Argonne National Laboratory, communicates in his work by writing and gesturing.

51 MARTHA A. BURKS (cerebral palsy), will soon receive her B.S. degree in computer science from Wright State University in Dayton, Ohio.

52 ROBERT A. REGAN, A.A. (learning disabled), is a medical laboratory technologist at Mary Thompson Hospital in Chicago.

53 HERMAN H. M. MUI (congenital encephalopathy) is an electrical engineering student with experience in solar and wind energy programs.

58 S. PHYLLIS STEARNER, Ph.D. — Author.

FOREWORD

Who are the disabled scientists? They include the head of a worldwide allergy research division of a large pharmaceutical company who is deaf, a field engineer who rides in a wheelchair, a zoology professor who is blind, a research biologist who has cerebral palsy, and a computer programmer who is quadriplegic and has no voice. These scientists are five of the over twelve hundred who serve as resources to the American Association for the Advancement of Science (AAAS) and to the science community.

Many of those in this resource group are members of the AAAS affiliated society, the Foundation for Science and the Handicapped, Inc., which sponsored this book. But the over twelve hundred member Resource Group of Handicapped Scientists of the AAAS is only a small representation of the disabled scientists who work in businesses and industry, on campuses, and in the field across the nation.

Most of these scientists have figured out how to minimize the effects of their disability on their everyday life and work. This includes learning science, coping with daily living, and getting and succeeding in a job in their chosen area of science. Society has much to learn about living and overcoming obstacles from these able scientists. Their experiences are especially important to disabled youth, their families, teachers, and peers.

Since the early 1970's, changes in state and federal laws have reflected a move toward assuring handicapped people's rights of access to education and to employment. In 1973, the AAAS was reminded of this new awareness by Dr. John Gavin, the deaf allergy researcher mentioned above and whose story is contained in this book. He asked that the concerns of disabled scientists be addressed by the Association. AAAS did listen to Dr. Gavin and asked him to give them more information about the needs of disabled people.

Gavin went to work recruiting other scientists to help him. In 1975 Gavin, with Dr. Edward Keller, Jr. who is also profiled in the pages that follow, sponsored a symposium titled "Who Disables the Disabled" at the annual AAAS meeting. Soon "Project on the Handicapped in Science" was launched by the AAAS. Dr. S. Phyllis Stearner, author of this book, joined Drs. Gavin and Keller in developing a plan. When AAAS began to ask questions about the needs of disabled people and the scientific community's responsibility to answer these needs, Gavin and his growing group of colleagues were ready to answer.

The AAAS joined Gavin in asking disabled scientists to identify themselves in order to form the Resource Group of Handicapped Scientists. Gavin and his persevering band of advocates grew to 500, then 750, and now to over 1200 disabled scientists and students of science who are willing to be resources.

The members of this group are diverse in their interests, both in science and in disability issues. A common thread that runs through the group is the interest in youth, a willingness to share experiences, and an incredible history of creative perseverence in overcoming barriers. From time to time the disabled scientists have been resources in:

- Serving as role models to disabled students interested in science
- Consulting with college and university science and math professors on accommodating the needs of disabled students
- Hosting a disabled student as a summer laboratory assistant
- Developing a computer data base on adaptive equipment found useful on the job
- Visiting science classrooms to "teach" a lesson or discuss their work
- Convincing employers to make science work sites accessible
- Assisting in out-of-school science activities such as museum visits or outdoor education
- Helping disabled students or disabled colleagues to solve problems they have faced
- Persuading the National Science Foundation, the American Chemical Society, the American Psychological Association, or other organizations in the scientific community to address the special concerns of disabled people

. . . Or even in:

- Organizing a group of able scientists with disabilities and others interested in their concerns into a formal organization, the Foundation for Science and the Handicapped, Inc., and attaining affiliation with AAAS (and its other 285 affiliated scientific societies and state and local academies of science).

The scientists with disabilities who have shared their life experiences in this book are similar to hundreds more across our nation who are working each day. As you read these stories you can know that the experiences are typical of other disabled scientists and youths who aspire to become scientists.

But many eager and motivated disabled students have been denied a proper education in the scientific field of their choice. It is not easy for a disabled person to overcome the barriers to getting an education or establishing a career in science, but it can be done. The hundreds of qualified scientists in the AAAS Resource Group attest to this fact. They are the fortunate ones who were in the right place at the right time, who were given an opportunity for an education, and then obtained a job.

The best help comes from those who have achieved and are willing to tell how they did it. The pages that follow share with you the experiencs of successful scientists who daily overcome barriers. Read and learn. Call on these and the other members of the Foundation for Science and the Handicapped and the AAAS Resource Group if you need assistance. Also most communities have disabled citizens who could be tapped as resources.

AAAS and I have found an unlimited wealth of information and guidance from John Gavin, Ed Keller, Phyllis Stearner, and the hundreds who have joined them to guide the educational and scientific communities toward providing full opportunity and participation in science to disabled people. I invite you to begin reading and then to join the challenge.

Martha Ross Redden, Ph.D.
Director, Project on the Handicapped in Science
Office of Opportunities in Science
American Association for the Advancement of Science

ACKNOWLEDGMENTS

Primary acknowledgment must go to those who gave the substance to this book — the twenty-seven individuals who were willing to share their life experiences. These experiences, and those of many other disabled scientists, have provided the inspiration for this book. My understanding as narrator and advocate in describing the range of capabilities for careers in the sciences and the adaptations that are possible by persons with physical disabilities has been widely broadened by the contributions to this book by the handicapped scientists themselves.

Anna Emery Hanson has earned the deepest gratitude of all those involved in advancing scientific careers for handicapped persons. She early on encouraged our activities with her interest, enthusiasm, and support. She has been the principal benefactor who has made possible the publication of this book. On behalf of the members of the Foundation for Science and the Handicapped, I extend heartfelt gratitude to this most gracious and generous lady.

We also thank G. D. Searle and Company for their contributions toward publication of this book.

To the many friends and colleagues who have read parts or all of the manuscript we are grateful for helpful suggestions and tactful advice. These people include Benjamin E. Thompson, Howard V. Rhude, Robert B. Johnson, Bert Michelsen, John F. Lytle, Viola Henrikson, as well as the twenty-seven people about whom we report. We also appreciate many timely discussions with friends and colleagues, disabled and nondisabled, that helped us to focus on critical issues.

Others have helped in many ways. They include Nora E. Bless, Betty Jean Wright, Rainer R. Weigel, Dorothy Unger, Katharine Allen, and John J. Racila.

Special thanks are due to those who have contributed their specialized expertise: Marcia W. Rosenthal, for her editorial assistance, valuable outside perspectives, and for contributing some words about the author; Rebecca F. Smith for helpful and thorough library searches; and Howard V. Rhude who took many of the photographs. We also thank those profiled persons who sent photographs of themselves in their working environments.

Finally, I take full responsibility for any errors or misrepresentations that may have inadvertently been included.

INTRODUCTION

The paths leading to successful careers in science and engineering are as diverse as the individuals engaged in these careers. While this is true for scientists and engineers in general, it is especially true for a certain subset of these groups: those who have some significant physical disability.

The FOUNDATION for SCIENCE and the HANDICAPPED, Inc. is concerned with increasing educational and career opportunities in science for physically disabled students. Many of its members know from personal experiences and the experiences of disabled friends and acquaintances that a career in science for handicapped persons may require overcoming a seemingly endless array of obstacles.

This book is a compilation of brief biographies of disabled scientists and students of science who are overcoming these obstacles and making careers for themselves in science or engineering. From examples known to the author, it includes persons of diverse interests, ranging from experimental microsurgery to engineering design, from synthesis of complex organic compounds to clinical psychology.

The major objectives in compiling this collection of biographical sketches are to illustrate possible career options open to physically disabled students and to bring the information contained in these examples to the attention of teachers and counselors (especially those in elementary and junior high schools) who are in positions to influence the future careers of disabled children.

The individuals described on these pages were willing to come forward and to share their experiences. The reader, however, should consider these biographical sketches only as examples — examples drawn from a much, much larger group of physically disabled people who have completed advanced academic programs and established successful careers in some field of science, mathematics, or engineering.

Within our society, few people realize that access to a career in science is restricted for the student with a physical disability. These restrictions, however, are seldom imposed by the disability itself.

The problems encountered by physically disabled students are similar to those experienced by female students, but there is a major difference. The problems imposed by the disability are little influenced by sex, and are shared by both men and women. As with females, disabled students must be strong within themselves if they are to pursue science, math, or engineering. In general, high schools do not encourage disabled students in these areas, just as they do not encourage girls.

Science teachers who are unaware of scientific career opportunities for disabled students, as well as counselors who are ambivalent about science careers, create an academic atmosphere that discourages disabled students from studying the sciences.

Many educators have had little opportunity to learn what professional scientists and engineers who happen to be disabled can and are doing. Disabled students, for their part, see few role models. As a result, uninformed and even negative views toward science, mathematics, and engineering prevail among both groups, as they do in the general population. At the same time, disabled students with avowed interests and talents in the sciences continue to be counseled into social studies and rehabilitation fields where jobs are scarce and interests are lacking.

The individuals described in the following biographical sketches have overcome numerous difficulties in obtaining their education and pursuing their careers. Not the least of their problems were disputes with those who told them their goals could not be achieved. Their accomplishments demonstrate the importance of giving every student a chance.

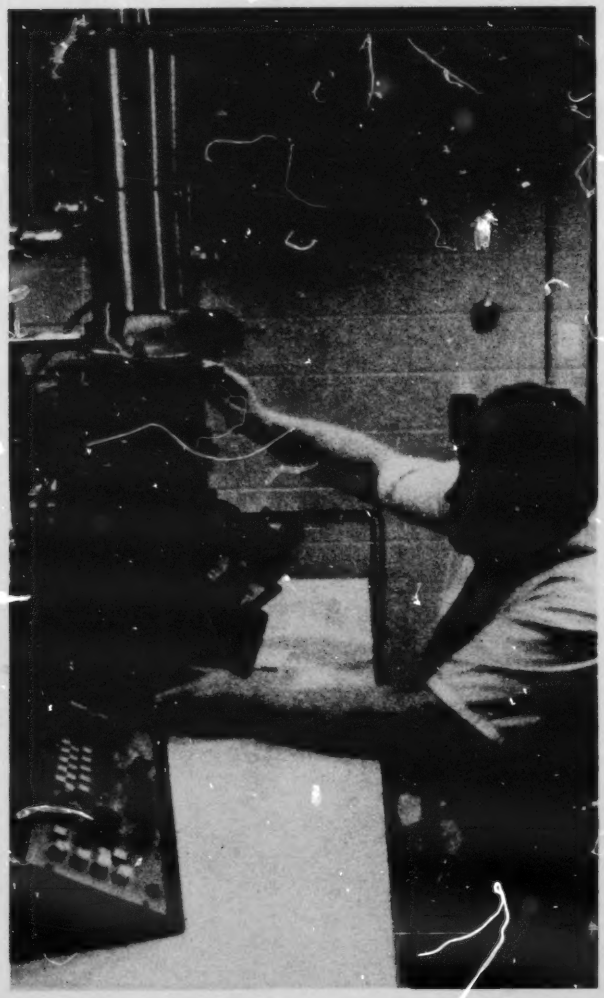
In these pages we hope to demonstrate convincingly that scientific and technical work, which can be largely mental in nature, scope, and content, is an area where success can be achieved by individuals with physical limitations. Nobel Prize winners have included such individuals.

Sir John W. Cornforth, who began to lose his hearing at the age of 14 and was totally deaf at 24, received the 1975 Nobel Prize in chemistry at age 58 for his research on the stereochemistry of organic molecules. James B. Sumner, who lost his left arm when he was 17 as the result of a hunting accident and became a chemist against the advice of his teachers, received the 1946 Nobel Prize in chemistry at age 42 for his preparation of the enzyme urease in crystalline form.

The need for scientists, mathematicians, and engineers is international. Let us make certain that contributions of the mind are not lost because of misconceptions about the limitations imposed by physical imperfections of the body.

BIOGRAPHICAL PROFILES

JOSEPH R. LARSEN, Sc.D.
PROFESSOR OF ENTOMOLOGY, DIRECTOR OF SCHOOL OF LIFE SCIENCES



Professor JOSEPH R. LARSEN, Sc.D. (paraplegic), operates an electron microscope as part of his studies of the morphology and physiology of the nervous system of arthropods. His time is largely taken up with administrative duties, however, in connection with his position as Director of the School of Life Sciences, the University of Illinois, Urbana.

Professor JOSEPH R. LARSEN (Sc.D) reports that his major scientific interests are in neurophysiology and the electron microscopic study of the nervous system. His current research deals with sensory physiology, fine structural studies of the morphology of sensory receptors, and analysis of structural relationships to neurophysiology and behavior. His responsibilities at the University of Illinois also include administrative duties as Director of the School of Life Sciences.

In his early years, the most important factor directing Joe into the sciences was a natural curiosity to seek answers to unsolved questions, an intense interest in delving into the unknown. There was also the fascination of trying to disprove established ideas that needed rethinking.

As a result of an automobile accident at age 25, Joe became a level T-2 (second thoracic vertebra) paraplegic and began using a wheelchair. He learned to drive a car with hand controls and modified his apartment to meet the new requirements. He then entered graduate school at John Hopkins University, in a program in parasitology and medical entomology. His choice was based on an interest in science developed in college level biology classes before his accident.

Joe found the physical situation at the university reasonably adequate and flexible. The building where most of his activities took place had a ground level entrance and sufficient room in the laboratories to manipulate his wheelchair. Parking space, however, was a major difficulty. Probably the greatest decision the university had to make was not that of admitting Joe as a graduate student, but of finding the low man on the administrative totem pole to give up a convenient parking space for Joe to use in getting from his automobile to the classroom. Going from one building to another on the downtown Hopkins campus was also somewhat of a problem, as there were no curb ramps and the streets had cobblestone pavement as well as streetcar tracks.

In graduate school, the height of laboratory benches was a recurrent problem. In the biochemistry laboratory, the university was persuaded to remodel a table in the lab where Larsen carried out most of his research so that he could get his wheelchair under the table to work with standard lab equipment and to use a microscope. Physiology labs were the biggest problem, where the 36-inch high benches were constructed for use with high stools and it was impossible to work from a wheelchair. In this instance the administration provided a small lower table so that Joe and his lab partners could work together.

Dr. Larsen had a difficult time finding a position after he had obtained his doctorate from Johns Hopkins and completed his postdoctoral training at the University of Pennsylvania. About a hundred job applications were turned down on the basis of his not being able to function from a wheelchair in a given situation. He was told that laboratory benches were not arranged so he could function in a wheelchair, that he could not reach the blackboard to lecture adequately because of the wheelchair, that he could not carry out his research program while seated in the wheelchair, and so on, over and over.

His first job following his postdoctoral experience was obtained through the good graces of a colleague at the University of Pennsylvania who had seen Larsen's accomplishments and had faith that he could do anything anyone else could do. After several years on the staff at Pennsylvania, doing research as well as teaching, he spent a year at the University of Wyoming. Then in 1963, he accepted a position at the University of Illinois where he has remained to the present, becoming a full professor and Director of the School of Life Sciences.

Professor Larsen has taught general biology, insect morphology and physiology, various seminars in physiology, and electron microscopy. His research program at Illinois has been in insect physiology and the fine structure of the central nervous system of arthropods.

Since being at the University of Illinois, Professor Larsen has had none of the accessibility problems that had plagued his earlier years, for here he found ramped curbs, ramped buildings, elevators in all buildings, and the campus entirely accessible to wheel chairs. At a time when these conveniences were rare, he felt that he "had died and gone to heaven."

In coping with his disability, Larsen feels that his determination to do whatever anyone else does, and do it even better, has been a most important factor in his success in the academic world.

He believes we must all be engaged constantly in educating other people to understand that to be physically disabled is not to be mentally disabled. He feels strongly that people with physical disabilities deserve the opportunity to learn and to have a chance to prove their capabilities.

JOHN J. GAVIN, Ph.D.
MOLECULAR BIOLOGIST, DIRECTOR OF RESEARCH

JOHN J. GAVIN (Ph.D.) is Director of Research for Hollister Stier Division of Cutter Laboratories (subsidiary of Bayer AG) in Spokane, Washington. His principal scientific interests are in molecular biology, specifically in immune regulation, T- and B-cell interactions, and lymphokine functions. At age 42 (eight years after becoming deaf, apparently as a reaction to a prescription drug), he obtained the Ph.D. degree in bacteriology from Rutgers University.

Unlike most of the scientists profiled in this publication, Gavin became disabled relatively late in life, after he had received the M.S. degree at Rutgers University and had been employed for some time as a microbiologist in the pharmaceutical field. He had not experienced the barriers in his early scientific education that have presented so many needless problems for aspiring disabled students.

Nevertheless, as Gavin points out, becoming disabled as an adult can be extremely traumatic. Marriages break up, children reject their parents, jobs and friends disappear. Essentially, roots are lost and the newly disabled person is faced with making a fresh start. Indeed, the problems faced by those disabled "after 30" can be even more severe than those confronting the disabled child in his times of maximum stress as, for example, when gaining acceptance into the regular school system. These difficulties of the adult are often not realized.

Gavin became interested in science during his service with the Army Medical Corps during World War II. He had been drafted at age 20 despite a spinal injury resulting from high school football, an injury that subsequently brought a medical discharge following service in England and France.

After his discharge, Gavin decided to prepare himself for a career in medical research. His orthopedic injury presented no significant barriers to his college studies, and after obtaining a B.S. in biology and an M.S. in bacteriology, he went to work for a drug firm as head of Biological Control and supervisor of the Antibiotics Unit.

Six years later when Gavin became deaf, he was Chief Microbiologist and was working in an administrative and supervisory position. He eventually lost this job, however, because he could not use the telephone or communicate with people. After sixteen months without a position, he was finally hired by a physician to do research on new drugs. Impressed with Gavin's abilities, the doctor later encouraged him to return to school to get his Ph.D.

It took Gavin almost three years of constant searching after he decided to return to school to find a supportive professor and a university that would admit him, despite the fact that he was author of more professional publications than some of the tenured professors in the institutions rejecting him. The excluse given was "you can't get a Ph.D. if you can't hear."

He finally went back to his alma mater, Rutgers University, where he was conditionally accepted by the head of the Bacteriology Department, Dr. Wayne Umbreit. Dr. Umbreit later served as Gavin's advisor, continuing his encouragement of his graduate studies.

In most lecture courses, Gavin used a tape recorder to get the material and his wife transcribed the tapes. In one course, Gavin copied the notes of his friend who sat in front of him, while on several occasions he arranged to "borrow the ears" of a fellow graduate student who helped to make tasks easier.

With his doctorate from Rutgers, Gavin went to work for Norwich Pharmaceutical Company in Norwich, New York, where he served as group leader of the Bacteriology Research Group.

To communicate after becoming deaf, Gavin learned to speech read and control his voice. He also perfected a technique for using the telephone, involving two telephones and a hearing person. In his office, for example, his secretary listens on one phone and repeats the conversation of the caller. Gavin speech reads her and then answers the caller through his own telephone. The person who called may have no idea of what is going on.

Dr. Gavin has four patents and has authored over 50 scientific publications. He has had an academic appointment as Adjunct Associate Professor in the Department of Microbiology at the University of Notre Dame, and currently is an Adjunct Professor in the Department of Biology at Eastern Washington University. He is listed in American Men and Women of Science and in Who's Who in America, and is a member of several professional societies.

Dr. Gavin is also a man with strong family ties; he is the father of nine children, four born after he became deaf, and enjoys several grandchildren. His recreational interests include swimming, handball, and pool.

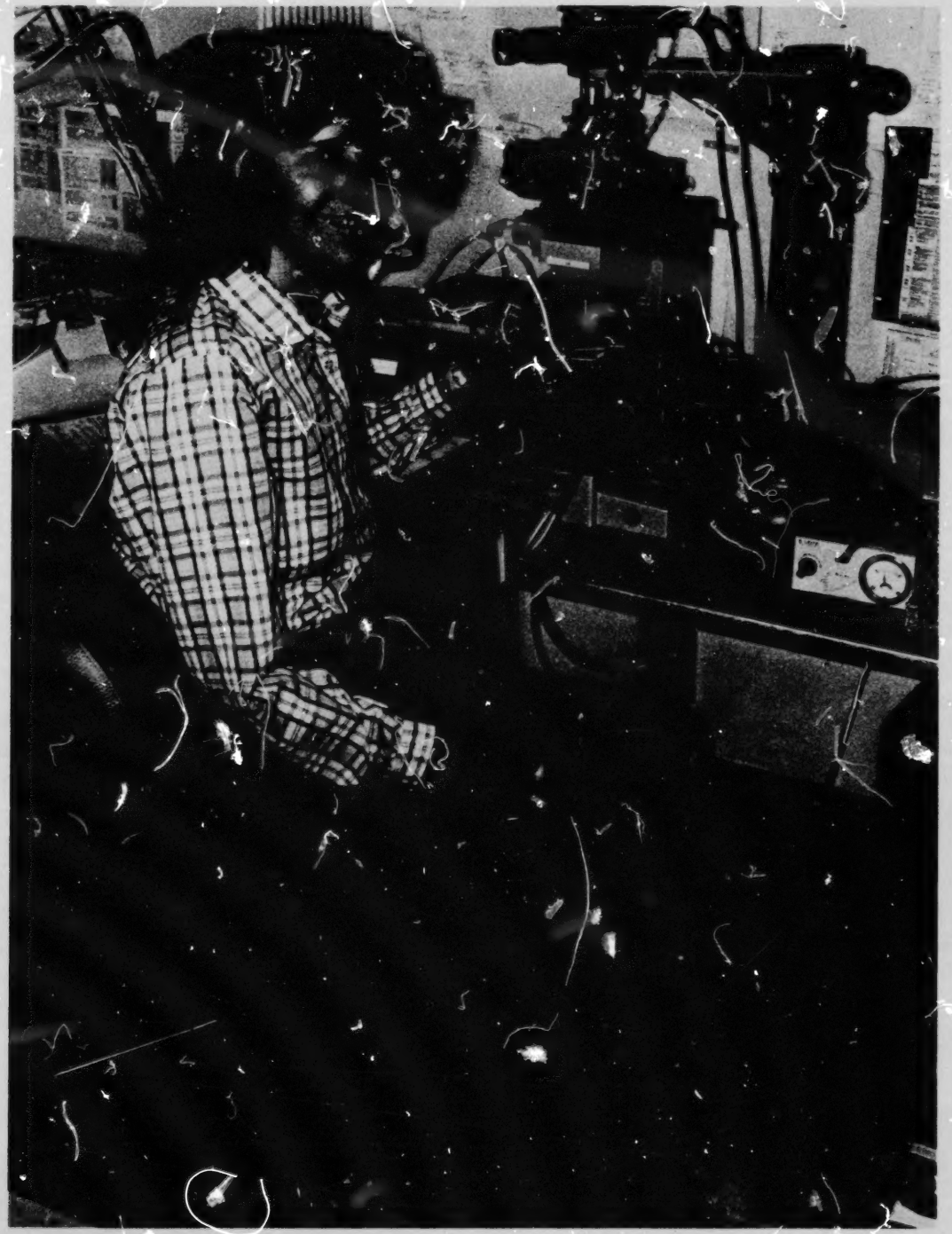
Yet he has little time for leisure activities, for he has a strong interest in the problems of the handicapped and has worked for adequate educational and employment opportunities for all disability groups. His efforts in this area include writing and speaking on the abilities and potential of handicapped persons. He serves on

JOHN J. GAVIN, Ph.D. (deaf), carries on telephone conversations as part of his administrative resonsibilities as Director of Research for Hollister Stier Division of Cutter Laboratories, Spokane, Washington. He speech reads his secretary as she repeats the caller's conversation, then responds by speaking into his telephone.

numerous boards, agencies, and advisory coucils of organizations of disabled persons, both locally and at the national level, and has received numerous awards and recognitions for his efforts.

John Gavin believes that persistence, humor, and a high self-esteem are valuable qualities in helping to cope with a disability, as is a realistic approach to resolving problems. Also helpful is a realization that others may have more problems than he, although their problems may be invisible. As noted for others in this volume, Gavin's career actually blossomed and flourished after he lost his hearing.

CYNTHIA DUSEL-BACON, B.A.
GEOLOGIST



CYNTHIA DUSEL-BACON (B.A.) began her career as a junior high school Spanish teacher. She had graduated with honors from the University of California at Santa Barbara, with a B.A. in Spanish and a minor in art history.

But Cynthia soon found she was more interested in geology than in teaching a foreign language she already knew. She went back to school and after three years obtained a second B.A. degree (with great distinction), this time in geology from San Jose State University. After graduation, she started to work for the U.S. Geological Survey (USGS) as a physical science technician in the branch of Alaskan Geology.

After three years in the USGS, Cynthia was attacked by a black bear while doing field work in Alaska. The result was loss of both arms, with severe lacerations of one shoulder and side. Extensive surgery, including a major skin graft, were required to repair the wounds. She then went through a lengthy period of rehabilitation, learning to use her feet and teeth as well as prostheses to restore the functions lost with her two arms.

With innovative approaches as well as time and effort, Cynthia gradually learned how to do many tasks. Help from an electrical engineer and machinist who worked for the USGS resulted in modified equipment that Cynthia could use. Support from her Branch Chief and other supervisors helped Cynthia make the adjustments necessary to return to work as a geologist.

The first geologic task she was able to resume a few months after her accident was microscopic study of rock slices, or "petrography." Her microscope was modified with foot controls and levers or rings that she could pull with the hook on the end of her artificial arms. A camera to photograph rock slices, mounted above the microscope, was equipped with an automatic film advance and a foot-operated squash bulb to snap the shutter. Cynthia uses a dictating machine to record descriptions of the rock slices.

Cynthia still does field work, but she comments that using her arms less has allowed her to use her brain much more than before. She collects data and writes up results of topical studies of metamorphic rocks in east-central Alaska. These scientific reports include her microscopic work, age data on the rocks provided by others she has interested in her project, and chemical data provided by USGS chemists but interpreted by Cynthia. She is author or coauthor of eleven papers and has reported the results of her work at scientific meetings.

According to Cynthia, her successful return to her profession is due in large part to the opportunities to show her mental capabilities provided by her Branch Chief. In addition to the project on metamorphic rocks in Alaska described above, she has responsibilities for compiling a map showing metamorphic information for all of Alaska.

Although she does not have a Ph.D. degree in geology, she has completed enough advanced work to be competent in her field of metamorphic petrology and was given the position of Geologist on the basis of publication record and general productivity.

Cynthia Dusel-Bacon was married about seven years ago, only a few months before her accident. Her husband, Charles Bacon, is also a USGS geologist. They also share interests in various outdoor activities, including hiking, bicycling, backpacking, swimming, and bird-watching.

Cynthia recognizes she has certain limitations that she must accept, but she plans to make the most of the abilities she does have. She has demonstrated that a career in geology is possible for a disabled person because many types of activities are involved in which physical limitations have little importance. "Geology," she says, "is multifaceted and not all aspects require physical dexterity."

CYNTHIA DUSEL-BACON, B.A. (arm amputee), a geologist in the United States Geological Service, uses a specially adapted microscope to study geologic characteristics of rock slices. Her microscope and attached camera have been modified with foot controls and levers or rings that she can operate with the hooks on the ends of her artificial arms.

HERBERT W. HOFFMAN, M.S.
METEOROLOGIST

When HERBERT W. HOFFMAN (M.S.), meteorologist and physical scientist with the U.S. Weather Service, was in high school, he literally hung out of his second floor bedroom window to track storms as they passed over Chicago. Herb became seriously interested in weather problems while he was in elementary school, but he recollects that his interest in science dates all the way back to age five. He soon began to study weather and to keep detailed records.

Later, when he attended the Jesse Spalding School, a special "segregated" Chicago high school for disabled students, Herb entered and won an award in the Chicago Schools Science Fair for his weather instruments and records. In the following years, his science fair entries included rain and tornado detectors that he developed himself. They were judged outstanding or first place winners in both the Illinois State Science Fair and the Chicago Schools Science Fair.

Herb has cerebral palsy and, as he points out, he was the first handicapped student in Illinois to enter a city or state science fair. He did so with only reluctant approval from his principal.

After high school graduation, Herb tried for two years to convince the Illinois Division of Vocational Rehabilitation that he could indeed succeed in college. During this time, he passed a correspondence course in math and worked on a tornado tracking device for an environmental research lab in Colorado.

He also told his story to the local news media. Soon after this publicity, the Division of Vocational Rehabilitation approved his attendance at Southern Illinois University, but on condition that he pass the first quarter with a "B" average. In other words, Hoffman was expected to maintain above average grades as he faced the challenges of a strange college environment with his handicap. Only later was this grade requirement changed to a "C."

Hoffman's career with the U.S. Weather Service began some time before his graduation from Southern Illinois University, when he obtained a part time job decoding ship reports to correlate forecasting errors. After he received his B.S. degree, he was put into a special Weather Service training program in which he continued to decode ship reports. When he had completed this program, Herb received a full-time GS-4 appointment, and little by little showed his supervisors what he was able to do.

At present, his responsibilities include recording the data on temperature, precipitation, and storm activity obtained from 65 weather observer stations in Illinois. He prepares weekly and monthly reports on this information which are later published in government documents.

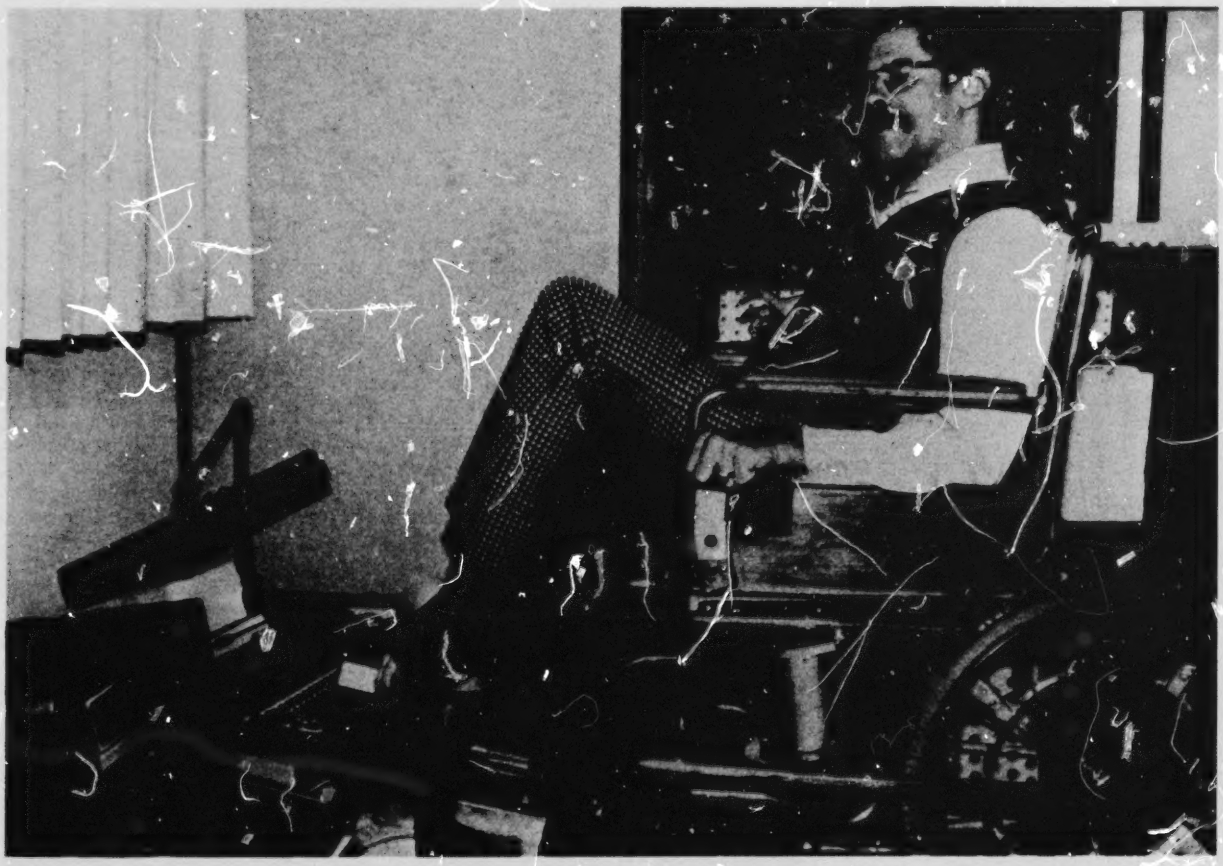
Hoffman also has analyzed data from satellite observations to determine seasonal changes in water temperature. When the project was completed, he reported his findings at an American Water Resources Association symposium. Herb often initiates an activity on his own, as he did in this instance. Then later, after he has successfully demonstrated his abilities, he is officially assigned to the task.

Although Hoffman worked hard at his job, he waited two years for a promotion to GS-5 level. Two years later he was again promoted, just before he received a presidential award as one of the ten most Outstanding Federal Handicapped Employees of 1977. A third promotion soon followed, to GS-7, when officials in the Washington office recognized that Herb should have a professional rating in the career ladder position of Physical Scientist.

Meanwhile, Herb was enrolled in the masters program in Earth Science at Northeastern Illinois Univeristy. He received the M.S. degree recently and now looks forward to additional responsibilities and regular promotions in the National Weather Service.

Hoffman feels, however, that his future is uncertain. He has often had problems in convincing his supervisors of his abilities. These difficulties are probably due in large part to his unusual special skills that he had developed to overcome his disability, skills that few people possess and that are known to few nondisabled persons. Herb drives his power wheelchair with his left foot, and he types and operates his word processor with his left toes because his cerebral palsy has left him no use of his arms and hands.

He learned to type at an early age and was encouraged by an elementary school teacher to type during class periods as he did at home. Over the years he has used



HERBERT W. HOFFMAN, M.S. (cerebral palsy), operates a microcomputer with his left foot. He uses a word processing program to prepare environmental reports in his job as physicist with the National Weather Service. (Photo by H.V. Rhude)

this skill in preparing papers for his courses, reports for his job, and scores of letters (many to civic leaders and government officials explaining the attitudinal problems faced by disabled persons and the need for corrective actions). Recently, Herb mastered a microcomputer word processor to increase his typing capability.

In high school his English teacher assured the students that they did not have to sit home and vegetate just because of a physical disability. She taught them to write letters to make their opinions known and to help themselves obtain their goals in life.

At Southern Illinois University Herb learned more about how to get things done and became involved with advocacy for the rights of disabled students. Since that time, he has worked with a number of organizations on issues of human rights for disabled persons, and on strategies for obtaining more and better education and job opportunities for these persons.

Hoffman's interest in science was stimulated by his high school science teacher and by his experience with science fairs. Although he enjoys his present job responsibilities, he hopes to have an opportunity to do research now that he has obtained his M.S. degree.

He believes that drive and determination to continue despite difficulties are the most important factors in coping with a severe disability. His prescription for positive action includes the following advice, "Don't give up, no matter what people say. Find ways around the road blocks. You have to keep fighting for what you want and understand that some people will not always approve of what you do."

DONALD L. BALLANTYNE, Ph.D.
PROFESSOR OF EXPERIMENTAL SURGERY

DONALD L. BALLANTYNE (Ph.D.), as summarized in a recent introduction, is currently at the New York Unviersity School of Medicine as "Professor of Experimental Surgery, Director of the Microsurgery Training Program, and Chief of the Microsurgical Research Laboratories for the Institute of Reconstructive Plastic Surgery."

The occasion for the introduction was Dr. Ballantyne's appearance at the Rochester Institute of Technology (RIT) as the guest speaker at the first Edmund Lyon Memorial Lectureship. This lectureship was established to commemorate Lyon, a pioneer in speech education for deaf students and an early trustee at RIT. Ballantyne spoke about his career and gave important pointers to the deaf students in the audience on success in the working world.

On this subject he speaks with authority. Although totally deaf since shortly after birth, he has worked for more than 30 years at one of the nation's major universities, carrying on scientific research in tissue and organ transplantation and administering research programs. Therefore, his advice on the importance of developing successful methods of communication with supervisors and fellow workers comes from experience.

Don was born in Peking, China, where his father was manager for an international banking corporation. He became deaf at about six months, after complications from extensive surgery and pneumonia.

Don considers his parents his "greatest good fortune." They planned and took steps to assure that their son's future life would be normal and well adjusted. Don's mother prepared herself and taught him speech reading and speech, so that he could attend regular schools rather than a school for the deaf. While Don attended many different schools during his early years in the Far East, his mother continued as his "private tutor," teaching him math, English, and other subjects.

But when he was eleven, Don was placed in private preparatory schools back in the States, as there was no higher education for American students in the Far East. All were regular schools, however, where he communicated entirely by means of speech reading and speaking, and depended on notetakers for help in understanding lecture material.

Don developed an early interest in science through field trips and classroom lectures. In addition, his experiences in the Far East, where he had witnessed much suffering among people in the disease-ridden earthquake and typhoon areas, had evoked a strong concern for human problems, especially in the field of medicine, and stimulated his interest in a medical career.

After graduating from Canterbury Preparatory School, Don was gratified to be accepted at Princeton University where he enrolled in a premedical program. On admission, however, the Dean recommended that he plan to spend five years instead of the usual four to ease the academic pressure due to his deafness. Don agreed, but then completed his studies in three and a half years. Those years were filled with satisfying experiences and he had a wonderful time.

Don soon made friends with his classmates and professors, who helped him after classes with explanations of material he had missed. His strategy was to distribute carbon paper to the three best notetakers in the class. Then he would put the notes together into a combined set so good that some professors bought them back.

From his experiences at Princton, Don believes that deaf students should learn to be independent of an interpreter, and should be able to understand lecture material by a combination of speech reading, notes from classmates and frequent conversations with them, as well as considerable additional reading. The independence and self-reliance developed by these procedures will be valuable in a future career.

Despite his high academic average and remarkable achievements in Princeton's premedical program, Ballantyne was rejected by all the medical schools to which he applied. The reason: his "hearing handicap."

He turned instead to graduate school at Catholic University in Washington, D.C. After obtaining his Ph.D. there in parasitology, Don found there were few positions in parasitology except in tropical countries, so he accepted an offer to do research work in transplantation. Although he knew little about the subject at the time, Dr. Ballantyne soon read the necessary literature for a foundation and to get started.

After this fortuitous entrance into a field that was to dominate his career, he went on to become a world authority in transplantation biology. He has authored two books and more than 100 articles on the subjects of transplantation biology, microsurgery, wound healing, and burns, and has lectured throughout the world. He only recently returned from a one-month lecture trip to Jerusalem, Zurich, and Heidelberg.

Recently Dr. Ballantyne was honored in Washington, D.C. by The Catholic University of America Alumni Association with the 1983 Alumni Achievement Award in the field of medical research. In addition, his career and research program at the Institute of Reconstructive Plastic Surgery, New York University School of Medicine, served as a focus for a new cable television program, "Reader's Digest Lifetime."

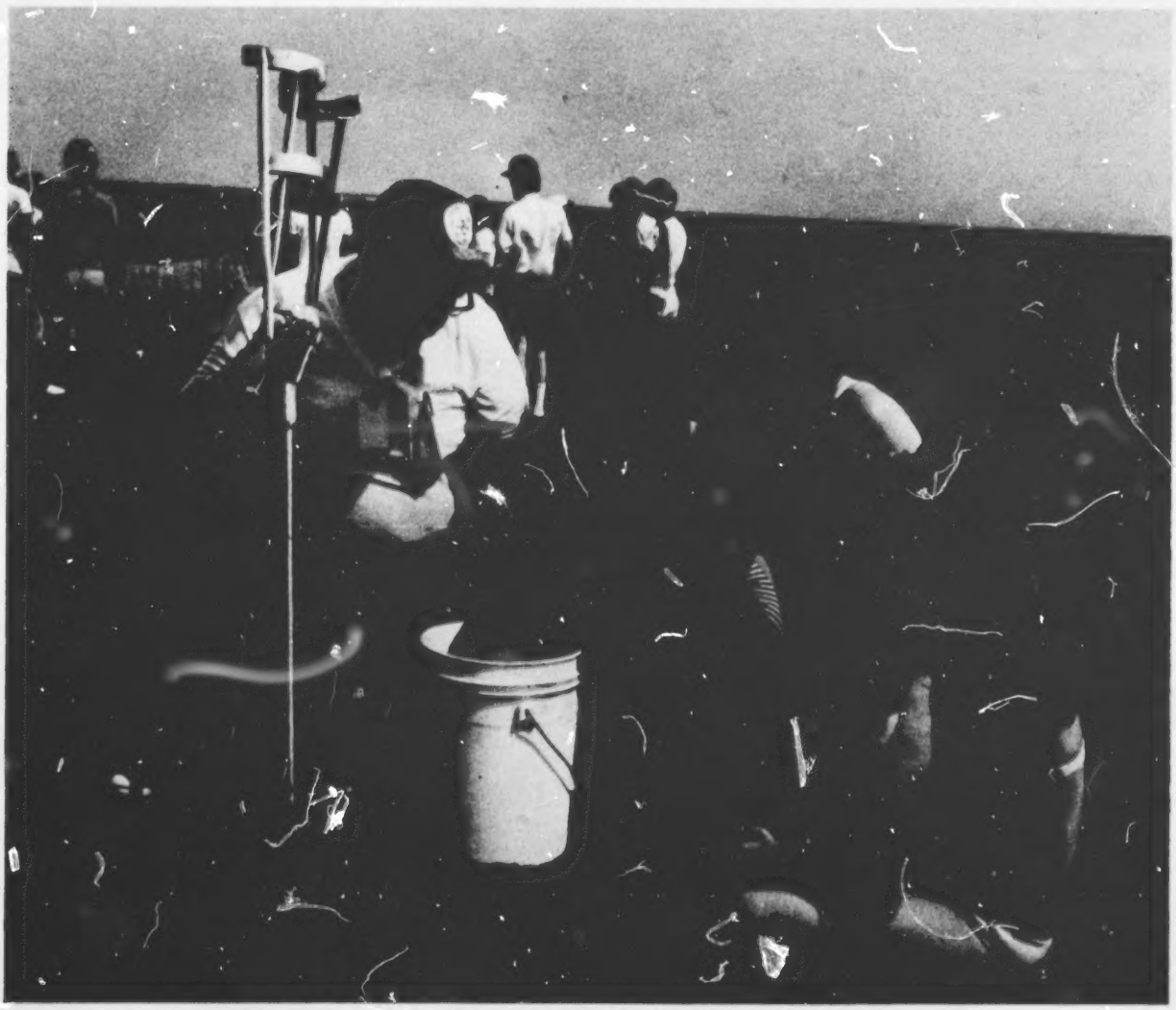
Professor DONALD L. BALLANTYNE, Ph.D. (deaf), shown at left, teaches one of his techniques in experimental microsurgery to a postdoctoral student. He is a world authority in transplantation biology at New York University School of Medicine.

Throughout his life, Dr. Ballantyne has lived in the world of hearing persons. His wife is not deaf and neither are their three children. As Don explains, he was 25 years old before he met another deaf person. At that time he believed that there were no more than one or two deaf people in any one city.

Ballantyne has learned to understand French, German, and Russian in order to better understand fellow scientists during his trips abroad. These skills are also useful when foreign scientists visit in his laboratories.

In addition to his scientific and family activities, Dr. Ballantyne is involved in many professional and community organizations. These include those involved with the hearing impaired and the physically handicapped, in which he holds leadership positions.

EDWARD C. KELLER, JR., Ph.D.
PROFESSOR OF BIOLOGY, ECOLOGIST, GENETICIST, STATISTICIAN



Professor EDWARD C. KELLER, Jr., Ph.D. (postpolio), demonstrates a marine specimen to three blind students in his field-oriented program in marine science, planned especially for physically disabled high school students.

EDWARD C. KELLER, Jr. (Ph.D.), Professor of Biology at West Virginia University, has held appointments at a number of other institutions during the past 25 years (including Pennsylvania State University, University of North Carolina, University of Maryland, and the NUS Corporation). He also has held short-term appointments at The North American Aviation Corporation and the U.S. Environmental Protection Agency.

During the academic year Keller teaches undergraduate courses in freshman biology and the human environment, graduate courses in ecology and genetics, and an occasional seminar.

In addition to his own research program, he directs graduate students in their research, serves on various state and national committees, and consults on educational, environmental, and statistical matters for government, industry, and other universities. During his professional career he has received about two million dollars in grants and contracts for his science and education programs.

Keller has written about 25 books, handbooks and manuals, over 60 scientific and educational papers, 93 abstracts and book reviews, and numerous reports. His latest book concerns strategies of teaching science to physically disabled students in the mainstream classrooms of secondary schools and colleges.

Ed Keller was born in a small New Jersey town near the Atlantic Ocean, where he received his early education. After his first year of high school, the family moved to a farm outside Danville, PA and he majored in vocational agriculture. In his senior year at Bloomsburg High School, Ed played a vigorous but second string tackle position for the football team. After high school graduation, he married Helen Baylor (thereby producing another "Helen Keller") and went to work as a plumber's apprentice.

In 1950, Ed contracted polio and lost the use of his abdominal and leg muscles, and some of those in his left hand. The direction of his life changed abruptedly. In the spring of 1951, Helen went to work to help support the family after the Kellers' first son was born. Meanwhile, Ed went off to The Warm Springs National Foundation for Infantile Paralysis in Georgia (founded by Franklin Roosevelt) for physical and occupational rehabilitation.

Despite the opinion of one of his doctors who told him he would never walk, Ed achieved partial recovery with physical therapy, hard work, and a strong determination to walk again. By fall he was ambulatory and returned home, fitted with stainless steel leg braces and aluminum crutches.

During Ed's stay at Warm Springs, the psychologist spent many hours with him discussing career choices and how his disability would fit into career goals. In occupational therapy he learned how to hand set type and, after returning home, he went to work setting type at a print shop in his home town.

He was laid off in a few months, however, because of slow business conditions. This was probably fortunate, for the Pennsylvania Department of Vocational Rehabilitation then offered to help.

Ed was given a series of tests and was soon enrolled at Pennsylvania State University, with full financial support. This did not cover expenses for Ed's wife and baby, however, so they remained in the Bloomsburg area while he worked on his undergraduate degree. During this period Ed's parents gave considerable moral and financial support which helped ease the strain on family ties.

Ed was fortunate that he could walk with crutches, and he was accepted without question as a vocational rehabilitation client. Had he not been ambulatory he probably would not have been accepted, as even in those times the rehabilitation counselors were aware of the many architectural barriers in colleges and universities for nonambulatory physically disabled individuals.

His major was in agronomy, reflecting his background and interests in agriculture, with minors in botany and economics. With this range of subjects, Ed's classes usually were located at opposite ends of the large campus. Since he could walk only at a slow pace, it was necessary to schedule most classes with a vacant period between, in order to allow him time to get across campus.

Ed found most professors at Penn State willing to adjust course schedules or field trips to help fit his limitations. Classmates provided the occasional pulls and pushes necessary over rough terrain and one professor carried Ed on his back over the streams they had to cross.

Of course, as might be expected, there were also professors who could care less about the problems of physically impaired students. The entomology professor, for example, conducted field trips at a fast trot to routinely leave Ed standing near the bus. Ed collected what insects he could near the bus, without the benefit of the trotting professor. Despite these problems Ed received an "A" in the course.

After receiving the B.S. degree in agronomy, Ed remained at Penn State to complete his Master's and

Ph.D. degrees in genetics and statistics. Helen and young son Eddie were then able to join him. Helen continued to work and Ed supplemented the family support with a U.S. Public Health Service predoctoral fellowship. A daughter Kim was born during this period.

When Ed completed his studies at Penn State in 1961, he declined a high paying job with the CIA and accepted a National Institutes of Health postdoctoral research fellowship. Dr. Keller continued his postdoctoral education in the Biochemistry Department of The University of North Carolina Medical School, where he assisted in teaching some laboratory courses, carried on research, and took courses at the UNC Medical School and School of Public Health.

Keller's principal research interests are in the effects of environmental stress on biological systems. For his investigations he has used a wide variety of organisms, ranging from viruses to humans. Currently, his major research is focused on external environmental influences on human health and mortality.

Dr. Keller also worked as a senior research engineer with the early Apollo space program and was a co-investigator in NASA's biosatellite program.

For five summers Dr. Keller directed and helped to teach a 6-week field oriented program in marine science for physically disabled high school students at the Marine Science Consortium's Wallops Island Station, located near the Assateague Island National Park in Virginia.

This "hands on" experience has helped to open doors to careers in science for over 100 deaf, blind, and/or mobility impaired youngsters. Many of them are now in college following their own programs in science. An award winning film, "You Can," has been produced describing this program. Not surprisingly, Dr. Keller was the technical director of the film.

In 1978 Keller received an honorary Sc.D. from Salem College, West Virginia for his work in the area of science and the handicapped. In 1982 he received the Oustanding West Virginian Award from the Governor, and the Distinguished Human Service Award from the Department of Health and Human Services for his work toward improving life for handicapped individuals.

Dr. Keller attributes his success to a number of factors — to the work ethic common among the people of Appalachia; to the social conscience of this nation in providing financial support that assisted him through university and postgraduate studies; to the financial and moral support of his parents during the early years after polio struck; and to the loving and unfailing support of his wife Helen throughout their years together. Clearly, considerable credit belongs to his own capabilities as well.

PAUL R. FILPUS, B.S.
COMPUTER PROGRAMMER

PAUL R. FILPUS (B.S.) is employed as a computer programmer at Miles Laboratories in Elkhart, Indiana. He has a degree in civil engineering from Michigan Technical University and worked in construction for a number of years before he was blinded in an automobile accident.

After losing his sight at age 29, Filpus attended the Computer Systems Institute in Pittsburgh where he learned data processing and computer programming. He was interested in science during his early high school days and also took full advantage of opportunities provided at a good scientific and engineering college close to his home.

Filpus originally perceived a career in science as a means to a secure and meaningful job that would provide a good living. Computer programming, as well as civil engineering, has fulfilled this expectation. Computer conversion of printed material into braille and use of electronic reading aids such as the Optacon enable him to function as well as a sighted programmer.

Filpus has reference material on both open-reel magnetic tape and in braille and uses a combination of reel-to-reel recorder, cassette recorder, typewriter, and a LED-120 braille terminal in his work. While he recognizes he misses a certain amount of nonverbal communication, Paul believes blindness sometimes stimulates conversation between the blind and the sighted.

A desire to pursue new and better ways of accomplishing tasks has been an important motivating force for Paul Filpus. Concerning the acceptance of his disability, he has this to say: "Adjustment to blindness has been quite a struggle. Acceptance of the fact that I'd never see again, starting all over in many ways through rehabilitation training, returning to a student environment — none of this was easy. However, the satisfaction I have gained from overcoming the problems and returning to gainful employment far outweighs the bad days."

PAUL R. FILPUS, B.S. (blind), a computer programmer at Miles Laboratory, Elkhart, Indiana, makes use of electronic reading aids such as the Optacon and of computer conversion of printed material into braille to facilitate processing of data.

NANSIE S. SHARPLESS, Ph.D.
NEUROCHEMIST

NANSIE S. SHARPLESS (Ph.D.) is Associate Professor of Psychiatry and Neurology at the Albert Einstein College of Medicine in New York City, where she directs a monoamine assay laboratory. As a neurochemist, she is engaged in basic and clinical research on the metabolism of neurotransmitter amines and their alterations in neurological and mental disorders.

Dr. Sharpless looks upon scientific research as an activity in "puzzle solving" and considers brain chemistry to be the most fascinating and challenging area of biochemistry. She directs students in the laboratory as well as assistants who work with her, and finds that her total deafness does not prevent her successful performance as a research scientist.

During her early years, Nansie had frequent contact with scientists. Her father was a biochemist, and there were many family activities to stimulate her interest in science. The family often visited natural history museums, there was nature study at girl scout camp, and vacations were spent on farms where her parents were raised. Above all her parents showed approval of her interests in science. In high school she had a year each of biology and chemistry and four years of math, and it was understood she would go on to college.

At age 14, however, following an attack of meningitis, Nansie suddenly became totally deaf. The communication difficulties that followed created problems for her in social situations in high school, but her scientific interests and goals for college did not change. While developing her speech reading skills, she was able to complete her high school education in "regular" school with the assistance of classmates, who lent her their notes, and teachers, who wrote extra material on the blackboard.

Her parents encouraged Nansie to obtain as good an education as possible in order to increase her employment options. She set out, therefore, to select a college with a reputation for academic excellence and at the same time one with small classes in which she would be better able to cope. Oberlin College was her choice, and she obtained a B.A. in zoology there.

Nansie became especially interested in medical technology as a career choice while a junior in college. She decided it would be well suited to her needs because it would not require a lot of verbal communication. For a graduate medical technology program, she went to Wayne State University which was one of only two schools offering such a master's degree program at that time. Her family was very supportive of her career choice, but she received little encouragement from either teachers or counselors.

After receiving her M.S. degree in 1956, Sharpless worked as a medical technologist in hospital research laboratories for 11 years before returning to school for a Ph.D. in biochemistry. Her doctoral research was on brain L-DOPA metabolism as reflected in cerebrospinal fluid, an area in which her "med tech" experiences proved to be useful.

Nansie had no difficulty in being admitted as a graduate student in chemistry at Wayne State despite her disability, but the faculty had not realized the implications of total deafness. When she began having difficulty with one of the required courses because the instructor did not put enough of the material on the board, many problems developed. Offers of financial assistance were withdrawn, basic procedural information was no longer volunteered, and routine matters became hassles with which she should not have had to cope.

Although many individuals in the department were extremely helpful, Sharpless felt that some of the faculty at first considered her presence to be a joke. Actually, she was about to receive her Ph.D. degree before some realized she had been a doctoral candidate!

Dr. Sharpless' present research program in neurochemistry started with her dissertation research and continued with her postdoctoral training at the Mayo Clinic, where she was accepted after she had been granted the Ph. D. degree. After several years at Mayo, she was appointed Assistant Professor of Psychiatry at the Albert Einstein College of Medicine in 1975.

She has authored many scientific publications in immunology and neurochemistry, based on her research while a medical technologist, on her dissertation, and later on her work at Mayo and at Albert Einstein. Sharpless characterizes her career accomplishments as a slow growth process, during which she took advantage of opportunities as they arose, rather than working toward her goal with a single-minded purpose.

Before she became deaf, Nansie Sharpless had expected to complete a four year college program, work a few years, then marry and become a housewife as her mother had done. Her deafness provided the stimulus to achieve higher education goals and a professional career.

NANSIE S. SHARPLESS, Ph.D. (deaf), neurochemist and Associate Professor at Albert Einstein College of Medicine, directs a monoamine assay laboratory and conducts research in neurotransmitters.

While Sharpless was working to achieve her career goal, she discovered many of her own capabilities and additionally succeeded in breaking down some of society's stereotyped concepts of the limitations of physically disabled persons.

"At one time," she said, "I assumed that a deaf person could not supervise co-workers. Then I did it, and that barrier fell. Likewise, I assumed that deaf people do not earn doctorates. When I did that, yet another barrier fell." She has since come to know that there are at least several dozen (and perhaps many more) deaf people in America who earned their doctorates after becoming deaf.

Dr. Sharpless is a member of several professional societies and serves on advisory boards and committees involved in increasing educational opportunities in science for disabled students. In her leisure time, she enjoys art and the theater, as well as travel, reading, and painting.

Techniques Sharpless has developed to meet her communication needs include speech reading in a one-to-one situation, the assistance of a secretary for telephone conversations, notetakers or oral interpreters for group discussions, business meetings or nontechnical lectures, and poster sessions for scientific presentations.

She considers that some ingenuity, a bit of aggressiveness, and the understanding cooperation of one's associates are important factors that will help a disabled person to achieve a successful career in science, and of course in other areas as well.

LAWRENCE WOS, Ph.D.
MATHEMATICIAN

LAWRENCE WOS, Ph.D. (blind), uses a Triformations LED-120 braille line printer and braille terminal. These can connect to the various computer systems with which he works in developing programs in automated reasoning. This research is a part of the program that Dr. Wos directs in the Mathematics and Computer Science Division at the Argonne National Laboratory near Chicago. (Photo by H.V. Rhude)

LAWRENCE WOS, blind from birth, has a Ph.D. in mathematics from the University of Illinois. He is employed in the Mathematics and Computer Science Division at Argonne National Laboratory, where his major field of research is automated reasoning. He leads a team which has developed a computer program that appears to imitate some of the reasoning skills of the human mind. This "automated reasoning assistant," or AURA for short, is a general-purpose reasoning program that can be used to design electronic circuits, detect flaws in other computer programs, and help solve previously unsolved problems in advanced mathematics.

Larry states that the AURA program demonstrates computers can be used as intelligent colleagues in some areas rather than merely as giant number crunchers. AURA functions through logical arguments. It is not modified into a special program to work on new circuit designs as some programs are, but can use instructions about how elements of the circuit work when they are provided in appropriate input language.

Educated in the Chicago public schools, Larry developed a special interest in arithmetic in elementary school and took extra math in high school. A teacher in high school, Ellen VanVliet, encouraged him to take the entrance exams for the University of Chicago and was influential in directing Larry toward a career in applied math.

Others also influenced Larry's career. A psychology professor helped him decide to major in math rather than psychology, a subject which also interested him in college. His mother was always supportive, "very much an incredible woman," Larry said. "I credit her with the fact that blindness has never been a big problem [in my life]."

Wos majored in math at the University of Chicago, from which he obtained B.A. and M.A. degrees. Then, while a graduate student at the University of Illinois, he prepared himself to be a teaching assistant in mathematics. But he was not accepted as an assistant by the university because certain administrators believed he would be unable to handle a class.

Faced with such possible difficulties in entering a teaching career, and thinking they would be magnified when potential school employers did not know him, Wos turned to the field of computers where there was a large demand for mathematicians "willing to dirty their hands . . ." Now, more than 25 years later, it has become clear that blindness does not preclude success in the teaching profession.

During his college years, Larry Wos received help from the Johanna Bureau, a group of Jewish women who put all types of printed materials into braille. As reading aids he uses the Optacon and the Triformations LED-120 line printer that can be used in local mode as a braille printer or hardwired directly into computers such as VAX. He prefers braille, which he reads very well, to tapes. His strong geometric sense, good dexterity, and attention to detail are all useful skills that contribute to his success in the fields of applied mathematics and computer science.

After receiving his Ph.D., Wos began in the Applied Mathematics Division at Argonne as a consultant to the programmers. As he demonstrated his talents over the years, he was encouraged by his Division Director, William F. Miller, to carry on certain research activities that eventually led to the automated reasoning program for which he is receiving nation-wide recognition today.

Dr. Wos, with graduate student Steven Wilker, received special recognition and a cash award when he was selected as the first recipient of the Automated Theorum Proving Prize for Current Research, presented by the American Mathematical Society at its 1983 annual meeting.

ODETTE L. SHOTWELL, Ph.D.
ORGANIC CHEMIST

ODETTE L. SHOTWELL (Ph.D.) is Research Leader of the Mycotoxin Analytical and Chemical Research group at the Northern Regional Research Center (NRRC) of the U.S. Department of Agriculture (USDA) in Peoria, Illinois. She directs research, writes scientific papers, project reports, and grant proposals, and she also handles administrative matters. In her early years on the job, however, Dr. Shotwell spent much time working in the laboratory despite a polio-induced paralysis that significantly limited her mobility.

Today, Dr. Shotwell depends on a motorized three wheeled cart (Amigo) for mobility. She is 61 years old, has worked in the NRRC laboratory almost 35 years, and has authored over 150 publications. Although she gives some thought to retirement, she plans to continue working as long as she finds it is fun and satisfying.

Odette grew up in Montana where her father was an entomologist for the Agricultural Research Service, USDA. She began helping him with calculations and tables while she was still in grade school. Then, just before she was to enter seventh grade, Odette contracted polio.

She was completely paralyzed at first and spent over a year in hospitals in Billings, Montana and Minneapolis, Minnesota, learning to walk with braces and to do things for herself again. After she returned home she could attend school only intermittently for several years, but kept up with her class with help from her parents and tutors.

During the years she was studying at home, Odette decided that she must obtain all the education she could in a demanding field so that "experts" would not have her "weaving baskets and crocheting potholders" the rest of her life. Her parents were very supportive of her efforts, helping her at home with her studies and her physical therapy exercises. In high school her father advised her about science courses, especially chemistry, and about mathematics.

Odette lived at home in Bozeman during her undergraduate college days at Montana State University. Her father had his office on campus and he as well as the chemistry faculty were very supportive, encouraging Odette to settle on organic chemistry as her field of specialization.

After college graduation in 1944 Shotwell was accepted in the Ph.D. program in the chemistry department at the University of Illinois in Urbana. She selected this university, although it was distant from her home town in Montana, because at the time it had the best organic chemistry department in the country.

Shotwell soon realized that the department was very demanding. She considers the time she spent there to have been an endurance contest, in which she was required to combine a three-quarter time teaching assistantship and a half-time course work program. All this was while she was living away from home for the first time and without assistance. The chemistry department showed little understanding and support for her situation and today she prefers to forget that period of her life.

Once she had obtained her Ph.D. degree, Dr. Shotwell found that getting a job was yet another problem, not only because of her disability but also because of her sex. The administration of the Northern Regional Research Center, one of many places to which she applied, was concerned about the liability risk of a disabled chemist. The laboratory chief of the Fermentation Laboratory recommended hiring her, however, because "she would be so grateful and work all the harder." She did. But Dr. Shotwell was not assigned an assistant as were other Ph.D.'s because "people do not like to work for a woman."

Dr. Shotwell's research has been concerned with the isolation, purification, and characterization of natural products of fermentation. Her early work included discovery of four antibiotics, two of them thirty years ago. Since 1964 she has directed the Mycotoxin Analytical and Chemical Research group. The group, now consisting of eight persons, has carried on chemical studies of aflotoxins, toxic secondary metabolites formed by fungi that grow on corn, peanuts, and other agricultural commodities. Under Dr. Shotwell's direction they produced the first large quantities of aflotoxins to be made available for experimental studies. Shotwell and her group are widely recognized and receive visiting investigators into their laboratory from all over the world.

Dr. Shotwell's many recognitions attest to her success in compensating for her physical deficiencies (she is much less strong than most women). In 1969 she was nominated as the USDA's handicapped employee of the year, while in 1980 her group was recognized by the Department of Agriculture and received the Distinguished Service Award "for contributing to the protection of human health." In 1982 she received the Weley Award, presented by the Association of Official Analytical Chemists for achievement in analytical chemistry.

Civic groups also have noted her accomplishments. In 1983 Peoria's Federal Executive Association selected her out of 1700 people as its Employee of the Year and Peoria's Pilot's Club named her Handicapped Professional Woman of the Year. In doing all she does Dr. Shotwell says, "I have more drive than energy."

Deep involvement with people as well as her work helps Shotwell to cope with her disability. Through the

ODETTE L. SHOTWELL, Ph.D. (postpolio), is an organic chemist at the Northern Regional Research Center, U.S. Department of Agriculture in Peoria, Illinois, where she heads a group of eight who are investigating the chemical nature of aflotoxins that occur on agricultural commodities. In her laboratory she examines corn seeds under ultraviolet light for a fluorescence indicating the presence of aflotoxins.

years, she has been active in a variety of ways as an advocate for the disabled, serving on committees, testifying at hearings, etc. She also has been active in social action groups. She is past president of the League of Woman Voters and for many years has been a member of the NAACP, where she chaired the education committee and organized a tutoring program to help disadvantaged youths finish school and plan for a career.

Dr. Shotwell believes disabled students starting out today will not have some of the problems she encountered, because changes have occurred in the areas of both education and employment. But at the same time she emphasizes the importance of having strong support such as she had from her family and her professors at Montana State College.

RICHARD W. KUSH, B.S.
MECHANICAL ENGINEER

RICHARD W. KUSH, B.S. (deaf), is Engineering Specialist in the Engineering Division at Argonne National Laboratory. He supervises drawing requests for the machine shop and works with reactor engineers on fabrication design. (Photo by H.V. Rhude)

RICHARD W. KUSH (B.S.) is an Engineering Specialist in the Engineering Division at Argonne National Laboratory in Illinois, where he has been employed since 1959. Soon after receivng his B.S. degree in mechanical engineering from the Illinois Institute of Technology in Chicago, he went to work at Argonne as a Draftsman C (sixth in the classification of drafting).

As he demonstrated his technical capabilities, despite his physical disability (total deafness), he moved up through the ranks to the top drafting position of designer at the end of four years. His duties then included working closely with engineers in the design and layout of reactor components.

After sixteen years as a designer, Kush was promoted to Engineering Specialist and assumed responsibility for supervising drawing requests for the machine shop and for fabrication procedures.

Deaf from birth, Kush attended the Bell Elementary School for the Deaf in Chicago. This was termed an "oral school" where communication was by means of speech reading only. Manual signing was not permitted.

After completing elementary school, he entered Lane Technical High School, in part because it was close to home. In addition, however, it had a small program for the deaf, and also a technical program in which Kush was interested. Although there were about 20 deaf students (out of 5000 total school enrollment), the instructors had no special arrangements for communicating and did not use sign language. Actually, deaf students were not truly mainstreamed at Lane, but had most of their classes as a group and associated almost exclusively with each other.

During this time, Kush was fascinated with drafting and was interested in the mechanisms of all types of machines. He spent many long hours disassembling such items as cameras and fishing reels, and then assembling them again.

In his third and fourth years of high school, Kush's supervisor in his part time drafting job encouraged him to go to college and take up science. After high school graduation he entered Gallaudet College in Washington, D.C., at that time the only college in the United States for the deaf. He enrolled in a liberal arts program because Gallaudet did not have the technical program he wanted. After two years he returned to Chicago and transferred to the Illinois Institute of Technology, in order to complete the requirements for the degree of B.S. in mechanical engineering.

Kush speech reads very well and in college was able to understand lecture material with only the aid of notetakers. He also speaks fairly clearly, and is understood after a little practice.

In his work, Kush finds communications a minor problem except in group discussions when interpreters are not provided. Of course, some people are more difficult to speech read than others and, when he runs into such a problem, he must rely on pencil and paper. He has a portable teletypewriter for the deaf (TDY) in his office so he can use the telephone. This is an important adaptive device for deaf employees, and is now being provided by more and more employers.

Kush has many outside activities, including some involving educational programs for the deaf. He is a member of the International Catholic Deaf Association, where he serves as vice president. He is also a member of the Chicago Catholic Club for the Deaf, and was its president for four years. His wife, who is also deaf, is a teacher in the program for hearing-impaired students at a local high school. Very much family oriented, the couple has four children.

ROBERT P. LARSEN, Ph.D.
ANALYTICAL CHEMIST

ROBERT P. LARSEN (Ph.D.) has been an analytical chemist at Argonne National Laboratory for more than thirty years. His principal scientific interests are in analytical nuclear chemistry, radiobiology, and environmental actinide chemistry. He also enjoys glass blowing and woodworking, and he makes his own braces and crutches.

Bob grew up in Kalamazoo, Michigan, where he contracted polio at the age of nine. After a year of treatment and recuperation, he returned to the elementary school he had attended previously. To walk, however, he needed full length leg braces and crutches. Two neighborhood boys were paid to get Bob to and from school, via coaster wagon or sled depending on the season. They also helped him up and down stairs, as Bob describes it, "on the seat of my pants, with one of the boys supporting my legs."

As a result of courses in general science and one in social science that was devoted in part to careers, Bob decided in eighth grade to be a math teacher. He attributed the decision in part to family support of higher education and in part to his own recognition of his math skills and his realization that a teaching career in math did not depend on physical attributes. Despite his logic, however, there were serious recommendations that "since he is good in math he should become an accountant."

His high school education could have been in a relatively new special school for the handicapped in Kalamazoo, but Bob and his family realized that the special school would give him an education that was separate but not equal. They decided that the educational advantages of "mainstreaming" in the regular high school outweighed the disadvantages, for example significant accessibility problems and no physical therapy.

The public high school was in a four-story building covering an entire city block. The entrance was accessible, so Bob could use a wheelchair to get from class to class, and he went from floor to floor via a freight elevator. Transportation to and from school was by taxi.

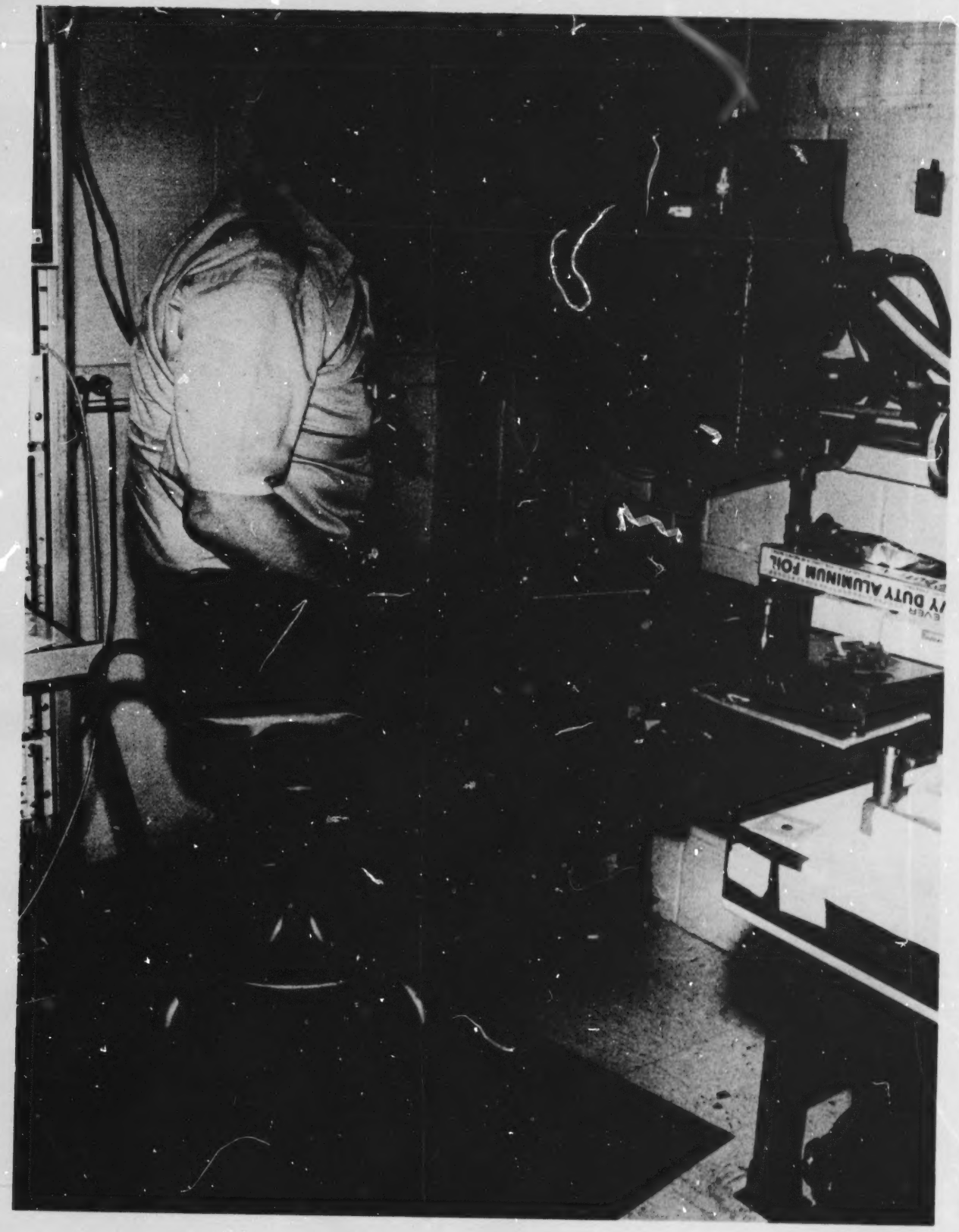
He selected a precollege curriculum with four years of math. In his senior year he took a chemistry course, during which he carried on a college-level project on the chemical analysis of brass. No questions were raised or restrictions placed on his work in the laboratory; he asked for and received what assistance he needed from other students. He was the one who decided what he could not do alone.

By this time Bob's career interests had turned to mechanical engineering. He learned that the State Division of Vocational Rehabilitation would pay for all college costs except room and board at a Michigan college of his choice. But at this point his hopes of becoming a mechanical engineer were shattered as a result of a short interview that he and his father had with the Dean of the University of Michigan School of Engineering. The Dean's opinion was that such a career would be impossible for one with Bob's handicap, and that he should try another field such as chemistry. Bob was crushed. What could a 17-year old boy and his factory-worker father say to counter the opinion of a university administrator?

At Kalamazoo College, Bob decided to major in chemistry, with minors in physics and math. Although the buildings were inaccessible, he could now negotiate steps and walk longer distances on crutches. He carried out his lab work either seated on a tall stool or standing in front of a 36-inch high laboratory bench. To improve mobility, he attached casters to the legs of the wooden stool so he could roll up and down in front of the bench. A refinement of this device, shown in the accompanying photo, is a laboratory stool fastened to a plywood platform equipped with large-diameter industrial casters. For more than 30 years, Bob has used this device while working at 36-inch high benches. By pushing with crutch and cane, he also uses it for transporting himself around the lab and even from one building location to another.

After graduation from college Bob entered the chemistry department at Brown University. The department chairman did not want to admit Bob for graduate study, believing that he would have difficulty in finding a job, even with a Ph.D., and that industry would be reluctant to hire a physically disabled chemist. Although Bob's persistence prevailed, he learned some years later that the chairman had been right. There was indeed considerable question about his being able to do lab work when he applied for a position at Argonne National Laboratory. Fortunately, Bob's department chairman had become convinced, and when questioned by Argonne staff he responded "I don't know what your problem is; Larsen can do anything that anyone else can do."

ROBERT P. LARSEN, Ph.D. (postpolio), is an analytical chemist at Argonne National Laboratory. When working in the laboratory, he sits on a stool which he designed himself to meet his needs. It is mounted on a platform equipped with large diameter industrial casters. While seated on the stool, he can transport himself about the room with the aid of a cane and crutch.


ALUMINUM FOIL

Since going to work at Argonne in 1951, Larsen has carried out research in nuclear fuel processing, analytical chemistry, and nuclear chemistry in the Chemical Engineering Division. In 1973 he transferred to the Radiological and Environmental Research Division where he has been studying the behaviors of actinide elements, including plutonium, in the animal body and in the environment. During his over thirty years at Argonne, he has been principal author of over 50 scientific papers.

Only in recent years has Dr. Larsen been involved in disability issues. He organized and taught an AAAS—National Science Foundation short course on teaching science to handicapped students and has written two articles on this subject. He also served for a number of years as chairman of the advisory council of the Illinois Department of Rehabilitation Services.

Bob Larsen is very much a family man. His wife is recently retired from a career in geology and their son and daughter have established themselves in their own careers. In his spare time Bob enjoys his hobbies as well as the tasks associated with needed repairs around their home.

As important influences in his career success, Larsen credits his highly supportive parents as well as those teachers who recognized his talents and provided him opportunities to prove his physical as well as mental capabilities. Contributing also, of course, were his own high degree of motivation and inherent ability.

After examining some of his thoughts about scientists with disabilities and the society with which they interact, Bob Larsen wrote down and sent us his ideas on the biases or preconceived notions (he calls them prejudices) held by the vast majority of nondisabled persons. We found his personal statement so interesting and pertinent that we reproduce it below.

The Lesson of Barney Miller
by Robert P. Larsen

Early in an episode of the television series "Barney Miller," an older man in a wheelchair is brought into the police station. He readily admits he is a shoplifter, and a good one, and ascribes his choice of this 'profession' to a system that would not give him legitimate employment. During the episode he slips away and is recaptured after a chase. At the end of the episode he is again trying to roll out of the room unnoticed. Barney remarks, "You have to admire his indomitable spirit."

With these words Barney Miller, a member of a class (Jews) that is subject to prejudice, a man whom we admire for such personal qualities as his nonprejudicial nature, has unwittingly made a prejudicial statement about another disadvantaged class. He is perpetuating a myth, that this kind of man is an exception within his class; due to some quality not ordinarily present in physically disabled individuals, this man is capable of a special accomplishment. In actual fact, this disabled man was only acting like an ablebodied shoplifter; blaming society for his fate, having little or no remorse, and attempting to escape from the authorities if an opportunity presented itself.

Similarly, the qualities of character of the able scientist/disabled persons who are profiled in this publication are, I believe, not very different from those of the able scientists/able persons whose accomplishments are comparable. I am a member of the former group and have known many individuals in both groups.

As I see it, each of the members of both groups has inherent talents and motivation, and these are the primary qualities which led to his/her accomplishments. The difference lies in some additional degree of motivation. The disabled persons have had to convince able persons that their disabilities do not forestall either their becoming or performing as able scientists. They have had to show these able persons — the counselor, the teacher, and/or the employer — that one can have mobility while being unable to walk, communicate while being unable to hear, and observe while being unable to see.

Was this additional degree of motivation such that the scientific accomplishments of these disabled persons/able scientists would have been significantly greater had they been able persons? Would the able persons/able scientists have failed to become able scientists had they been disabled persons? And if they had become able scientists/disabled persons, would their accomplishments have been significantly less? My response to each of these questions is assuredly a negative one.

Each of the individuals whose profiles have been compiled in these pages, like the man whom Barney Miller admired, is disabled, is a professional, is independent, and has had attributed to him/her at one time or another very special personal qualities. This group of scientists has already been so endowed by an individual who read these profiles in manuscript form; he regretted that the title "Profiles in Courage" had already been used. He, like Barney Miller, when considering the accomplishments of these able scientists/disabled persons, was faced with what he considered to be an incongruous situation. His resolution of the incongruity reflects a prejudice, an "adverse judgment formed without knowledge or examination of the facts." Like Miller, he believed that those within the disabled population who have established themselves in a professional career are individuals who have a capacity for calling upon certain special personal qualities, ones which our society highly admires: those that convey nobleness, inner strength, indomitable spirit, even inspirational courage.

Unless this belief is dispelled, one of the most important messages in this collection of profiles could be lost. This collection is not a series of human interest pieces analagous to those that appear from time to time in newspapers, in magazines such as the Reader's Digest, and on television shows such as "That's Incredible" — pieces that I have come to categorize as "Isn't he/she wonderful?" They are simply descriptions of the accomplishments of individual scientists, persons who only incidentally are disabled.

They are examples for able/disabled students who may have aspirations to become able scientists/disabled persons and who ask only for opportunities to develop their own interests and capabilities. They are testament to teachers, counselors, parents, and society in general that if they help in providing these opportunities, the disabled person who has talent and motivation can become an able scientist.

Rest assured that I do not feel unkindly toward the Barney Millers. Their statements are meant to be complimentary and I admit to feelings of pride when such statements are directed at me. At times I also derive vicarious pleasure when they are directed at others, e.g., Barney's remark about the shoplifter. I too have feelings of awe when I weigh the accomplishments of some able scientists/disabled persons against the nature and/or severity of their disabilities. The easiest way out is to ascribe their behavior to an indomitable spirit.

The majority of the nondisabled persons who read this publication and think about the materials that are presented, will come to realize the nature of the primary barrier to success for these and thousands of other able scientists/disabled persons. The barrier was not the disability per se, but the inability of able persons — the counselors, the educators, the employers — to appreciate that careers in science are primarily intellectual endeavors, not physical ones.

ANNE B. SWANSON, Ph.D.
BIOCHEMIST

ANNE B. SWANSON, Ph.D. (osteogenesis imperfecta), is Associate Professor of Chemistry at Edgewood College in Madison, Wisconsin. Dr. Swanson uses an elevated platform with a railing and attached set of stairs to carry on her work in the lab, and also to reach the height needed for blackboards and lecturing.
(Photo reprinted with permission from "Mobility-Handicapped Individuals in the College Chemistry Curriculum; Students, Teachers and Researchers," T.A. Blumenkopf, A.B. Swanson, and R.P. Larsen, Jour. Chem. Educ., 58, 213-221, 1981.)

For as long as she can remember, Mrs. ANNE BARRETT SWANSON (Ph.D.) has been interested in science. This is a result, she believes, of an intense natural curiosity. A "fabulous" general science teacher in junior high school helped to encourage Anne's interest. In high school she had four full years of science, including the accompanying laboratory activities.

At 34, Dr. Swanson became Associate Professor of Chemistry in the Department of Physical Science at Edgewood College, Madison, Wisconsin, where she teaches general and organic chemistry and biochemistry. During summer breaks, she continues her research program at the University of Wisconsin at Madison. Her major research interests are in environmental toxicology, especially relating to naturally occurring carcinogens, and the interactions of nutrition and carcinogenesis. She has investigated mechanisms of chemical carcinogenesis and mutagenesis by naturally occurring alkenylbenzenes, the metabolism and nutrition of selenium, and the physical biochemistry of model compounds.

Dr. Swanson's disability is short stature, resulting from a congenital defect in bone development, osteogenesis imperfecta, commonly known as brittle bones. During her elementary, secondary, college, and graduate years, she used a specially designed walker on wheels that also served as a chair. Now, however, she uses only a cane for walking.

During elementary and secondary schools, Anne received encouragement from her parents and teachers to do as much as she could in her classes. No artificial barriers were set up to obstruct her progress through regular public schools. Electing a chemistry major at Northern Illinois University in DeKalb, she carried out the required lab work with the aid of several elevated platforms of appropriate heights to bring her up to easy reaching distance of the equipment (see photograph).

Each platform has a railing and is provided with an attached set of stairs. The platforms are constructed of sturdy, light weight wood and can be easily pushed from one lab to another. Anne also uses a platform in lecturing in order to reach the blackboards.

Swanson received a B.S. in chemistry from Northern Illinois and a Ph.D. in biochemistry from the University of Wisconsin at Madison. She then obtained a postdoctoral appointment to work with Professors James and Elizabeth Miller at the McArdle Laboratory for Cancer Research, also at the University of Wisconsin.

In order to cope with her disability, Anne finds she frequently must take the initiative in putting people, especially figures of authority, at ease with her. This is essential if they are to provide her with opportunities to demonstrate her abilities. She finds it has been necessary to work very hard, and to make no excuses of any kind for herself in her school or work assignments. She also believes it is important to develop a balance between being assertive and being informative about her abilities, while at the same time not appearing overly aggressive and overbearing.

As a student, Dr. Swanson received several awards recognizing her performance. These included the Northern Illinois University Chemistry Department's "Outstanding Chemistry Student Award," the American Institute of Chemists Student Medal Award, and a Procter and Gamble Research Fellowship.

Dr. Swanson is a member of several national and international societies, and serves on national committees. She has authored and coauthored a number of scientific papers describing the results of her research, and has presented reports of these findings at scientific meetings.

KIRBY L. MORGAN, M.S.
PHYSICIST, COMPUTER ANALYST

KIRBY L. MORGAN (M.S.), of Handi Computing, does contract computing. He has designed computer assisted physics and calculus lessons for college students. He also has written programs for a furniture manufacturer to create, edit, and plot office layouts, and list information about the components in the layouts. He has access to the statewide college computer network through Michigan State University and to the Control Data Corporation Network, allowing him to communicate with co-workers in Minneapolis and other parts of the country. Morgan carries on his computer activities from his bed in his home in Charlotte, Michigan, because he is disabled with rheumatoid arthritis.

Morgan has had rheumatoid arthritis for thirty years. When he was eight he began to notice small joint aches and stiffness. As the years went by, the condition slowly worsened. He started using crutches in high school, and had to use a wheelchair by the time he reached his senior year in college. That year he did all the course work by correspondence, as he was confined to his home. This was somewhat difficult because he lived in Michigan and the college was in Florida. Nevertheless, he graduated with highest honors, receiving the B.S. degree in theoretical physics and mathematics.

Kirby Morgan first became interested in science while he was in sixth grade, the year Sputnik was launched. When he was 16 and in high school he attended the High School Honors Science Institute at Michigan State University (M.S.U.). He credits innovative teachers with important help in establishing his science program.

For his graduate studies, Morgan still had to work from his home, so he chose nearby Michigan State University at East Lansing, Michigan. After fulfilling the requirements, he obtained the masters degree in physics. He was confined to his bed by this time, and could move only his right hand and arm.

Job prospects appeared to be almost nonexistent when Morgan graduated in 1972. Most companies could not even conceive of a physicist working independently at home. Unable to find regular employment, he began working part time for Michigan State University, developing instructional materials for physics courses. This led to involvement with microcomputers, because the project on which he was working used them to edit the text for self-paced physics lessons. At this point Morgan began to realize the potential of microcomputers for improving his job prospects.

The Michigan Bureau of Rehabilitation, despite their initial reluctance, agreed to provide Morgan with a computer system that included the computer itself, special high resolution videographic boards, a keyboard, a video monitor, two 8" double density disk drives, and a 300-baud modem for communication by telephone with other computers. Software included Microsoft BASIC and FORTRAN, and special programs to display scientific text.

Morgan had to wait a year for the system, but he put the time to good use by reading about programming and computer operation. But it was not until he could actually use the computer that he began to understand how it worked. Learning required considerable trial and error and several telephone calls to the computer store and M.S.U. for help.

The first problem to be resolved was the physical layout of the system. Morgan's position in bed, three and a half feet above the floor, was too high to allow access to the computer if it were placed at standard height. Rehabilitation engineers from M.S.U. provided a special movable cart so he could reach and see the keyboard and monitor. With this arrangement he was able to begin working with the machine.

Morgan quickly came to appreciate the benefits of word processing, the satisfaction in being able to change the text around and then type out a perfect copy the first time. Initially, he did not have a printer, but sent his files by modem and a terminal program to the physics department at M.S.U. where the material was printed out.

He also started programming in BASIC and did some experimenting with FORTRAN and 8080 assembly language; he then took a computer programming course at Michigan's State Technical Institute and Rehabilitation Center (STIRC).

This too was a correspondence course, but now Morgan's computer was a remote terminal connected to a large computer at Western Michigan University. He learned how to create and edit his programs using his own computer, then to transfer them to the larger one. In addition, he learned COBOL and more of the finer details of computer programming.

STIRC has a strong relationship with most types of businesses in southwest Michigan. In the spring of 1981, Herman Miller, Inc., manufacturer of office furniture, employed Morgan to do contract work for them. He wrote some programs in BASIC and later evaluated new software packages for them, while they designed a moveable work station for him as part of a program to develop special carts that could be used to hold computers for disabled people. The Bureau of Rehabilitation also developed moveable work stations for Morgan, thus allowing him to use different computers as the need arose.

From his bed, KIRBY L. MORGAN, M.S. (rheumatoid arthritis), can reach and see the keyboard and monitor of his computer, which is located on a special height, movable cart. He is a theoretical physicist and does contract programming for Michigan State University in East Lansing and Control Data Corporation in Minneapolis.

Even before Morgan had obtained a computer, Control Data Corporation (CDC) in Minneapolis contacted him about working for them through their HOMEWORK program, which has been used to rehabilitate disabled CDC employees as well as other disabled persons. After a number of discussions, Morgan signed a one-year contract with them in 1982. They provided him with a terminal and access to the Control Data Network, which gave him access to co-workers throughout the country.

His first assignment from the HOMEWORK program was to write a series of physics lessons dealing with oscillatory motion for a computer-assisted set of instructions. Morgan reports that this program not only has provided him with employment in his selected field of science but has allowed him to make new friends. He can communicate daily with people who have interests similar to his.

While he recognizes that barriers to employment of the homebound still exist, Morgan believes they are due to attitudinal deficiencies rather than lack of adequate technology. In the future, as more and more people work out of their homes, he stresses it is imperative that disabled persons not be excluded as they have in the past.

Morgan is satisfied to be able to pursue his interests in computer applications in physics and math education. He recognizes his talents in this field and believes he has a right, as does every competent person whether disabled or not, to have access to a career. Morgan believes "To exclude disabled persons is not only grossly unfair but is a waste of one of our nation's greatest untapped resources."

HARVEY L. LAUER, M.S.
REHABILITATION RESEARCHER, EDUCATOR

HARVEY L. LAUER, M.S. (blind), uses and tests tactile output devices with vibrating letter shapes, as part of his duties at the Hines Veterans Administration Hospital near Chicago. (Photo by H.V. Rhude)

HARVEY L. LAUER (M.S.) is an Electronic Reading Machine Specialist at the Veterans Administration Hospital in Hines, Illinois. He tests all types of reading aids for blind people and also teaches their use. Blind since birth, one of his main interests is to improve the interfacing of people with machines.

Lauer has been involved in teaching and evaluation research on communication aids, especially reading machines for blind veterans, since 1961 when he first went to work for the Veterans Administration. He has used and taught the use of eight different models of reading machines, as the technology advanced.

First tonal output aids became available, then tactile output devices with vibrating letter shapes appeared, and finally there were synthetic speech and braille output aids. He routinely tests all aids before teaching their use or recommending them to blind veterans. Lauer believes that all available types of outputs are needed, either together or as options. So far, however, there is only partial resolution of the needs for such devices.

For his formal education, Lauer experienced the three settings most commonly proffered to the disabled. Elementary school was in a Milwaukee public school that had a special home room and training for the visually impaired. High school, on the other hand, was in a state residential school for the visually impaired in Janesville, Wisconsin. College was again in a standard setting at the University of Wisconsin in Milwaukee, where almost the only special service was a small stipend for paying readers.

As is frequently the case, Lauer found that science courses with laboratory requirements were about the only courses he had trouble getting into. Fortunately a physics professor allowed him to enroll in some lab courses in which he was introduced to much of the background he would need for the technical aspects of his present work. He was graduated in 1956 with the B.A. degree in sociology.

In graduate school at Hunter College in New York City, Lauer trained for a career in rehabilitation teaching and obtained an M.S. in vocational rehabilitation. Although some professors encouraged him toward a career in social science research Lauer turned down this option because of the large amount of reading involved. He felt he would not have time for such a career and a family as well. At the present time his research role involves application of a "baby boom" in technology that cannot come fast enough to meet fully the reading needs it has fostered.

In his first positions after graduating from Hunter College, Lauer counseled newly blind people and taught braille and daily living skills. These activities provided an ideal background for teaching and testing reading aids, while Lauer's avocations of music and audio-electronics led him into "investigative tinkering" that has proved to be essential in his present task of interfacing people with machines. In fact, much of his work involves testing and adapting available technology. He learned to read by tones as his young daughters learned to read by sight. The first machine that crudely converted letter shapes into tone patterns proved useful for reading mail, typing checks, and filing. While this machine was soon classed as "garbage," valuable lessons were learned from its use.

In recent years, Lauer's involvement in applied research has expanded to include instrumentation, for example speech compressors, speech synthesizers, and braille displays for computers. Despite this newer technology he says that he still uses tones for the tasks the computer cannot do, and for the bulk of the reading some human help is needed.

Harvey Lauer has much to say about the potential for successful adaptations of technology to meet the needs of disabled consumers. He believes success in this generation depends on the collaboration of the people who control the needed technology and the survival of our tenuous socio-economic system.

The most important influences in directing Lauer toward the sciences were the existing needs and his skills. He has attempted to select tasks that are best suited to his abilities, then become well trained in these areas, and ask for only those items that were absolutely essential. For Harvey, "Life is heartbreaking and heartening; it is exciting and frustrating; it is being instructive to self and helpful to others. Above all, it is to take one's place as a part of the master plan."

JUNE M. ROOKS, B.S.
PHYSICIST

JUNE M. ROOKS (B.S.) is a physicist in the Avionics Division of the Aircraft Weapons Integration Department, Naval Weapons Center, China Lake, California. Using software she has developed, Rooks analyzes results of test flights. In addition, she develops software to aid the systems analyst to determine aircraft sensor performance.

June Rooks was born and grew up in Vicksburg, Mississippi. When she was 16 months old polio left her severely paralyzed, and she had problems getting around during her early years. She gradually gained strength, however, and today uses only a leg brace and crutches. June had the good fortune to grow up in a supportive family that valued education second only to religion. She was treated no differently than the others in her family of seven.

When the time came for June to enter school she could not attend the public school because it was not accessible. Her parents tried to register her in a small private school, but she was not accepted because the other parents were afraid her polio was still contagious. Another private school would accept her, but the Rooks could not afford the tuition. Her father had been unemployed for a year because of a work-related injury that resulted in loss of his leg.

The parents tried unsuccessfully to get the Superintendent of Schools to establish a school for nonretarded handicapped children. The solution then worked out was to have the teacher at the school for mentally retarded children teach June separately. But the family no longer had a car and there was no transportation to get her to the school.

So, for some time, June learned from her brothers and sisters and from the children in the neighborhood, while her parents taught her to read from the Bible. Playing school was one of her favorite games. June did attend Sunday school every Sunday, which provided a big part of her early education. Her participation in many church programs helped her learn about overcoming stage fright at an early age.

It was a difficult time for the family as their financial problems continued. But when the family finally began receiving Social Security benefits in 1960 June's life reached a turning point. Her father registered her in St. Mary's Catholic School and at the age of ten she started off in the fourth grade. It was the happiest day in June's young life. Although financial problems remained, their biggest worry was over. They exclaimed, "June is in school!"

When June finished sixth grade, her teachers felt she was far ahead of her class and she was promoted to eighth grade. That summer she took ninth grade mathematics in summer school and scored in the 93rd percentile of the class. At eighth grade graduation June received one of the awards for best student in the class. How proud her parents were of her blue ribbon!

June went on to what is now Vicksburg High School where she was an honor student. Although the building was not accessible by today's standards she had become much stronger and was able to manage even the stairs with her crutches and leg brace.

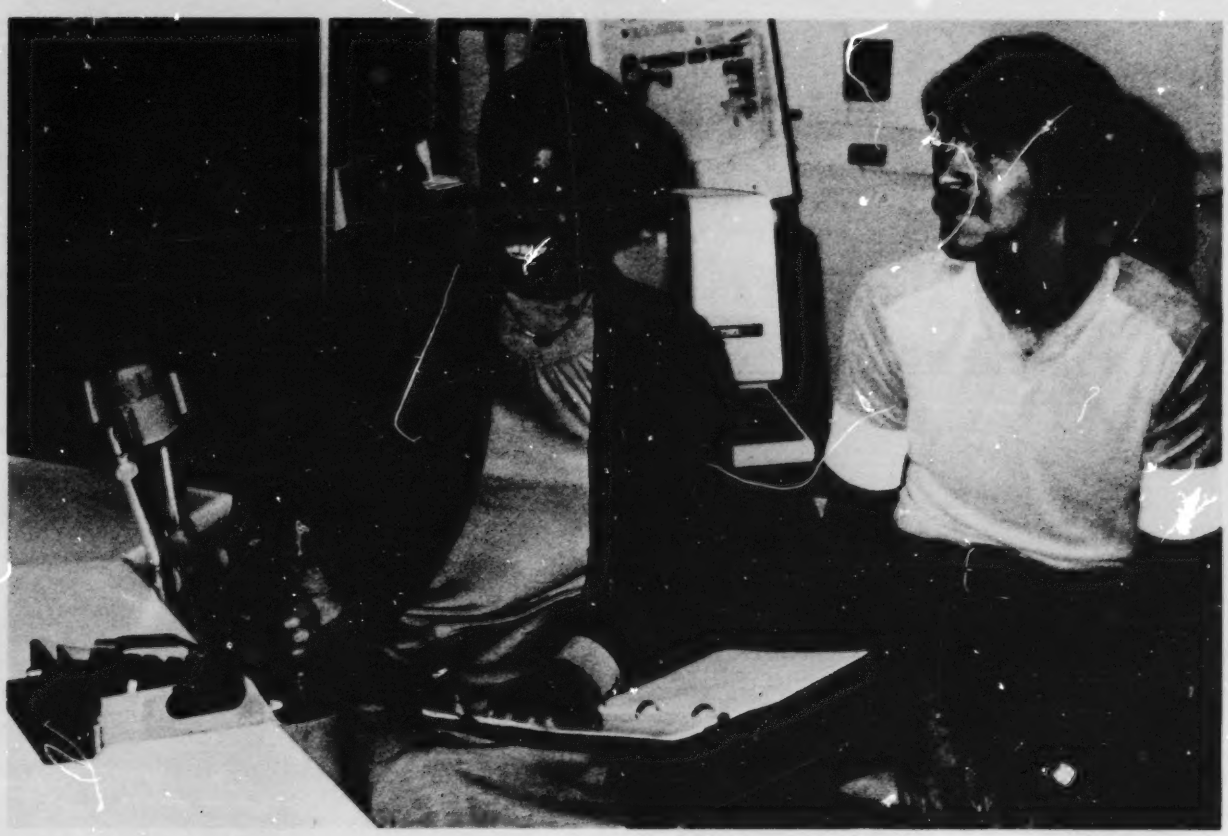
In her junior year the students elected June "Miss English" and she was in the homecoming parade. In her senior year she was elected vice president of the student body, president of the Chemistry Club, and also president of the National Honor Society. She was voted most likely to succeed in her high school class of 186.

After high school graduation, the Mississippi Department of Vocational Rehabilitation paid for most of June's tuition, room, and board at Jackson State University. The rest of her expenses she paid herself by working at part-time jobs. But no matter what she needed after high school, she never again asked her parents for money. She felt they had done enough in getting her that far along and giving her love, patience, understanding, and the will to succeed.

As an undergraduate student June decided not to join a sorority. Living in the dorms was fun but most of all she enjoyed learning. She was both a Dean's List student and a President's List student (all A's). During her second summer in college she received a grant to study gamma ray spectroscopy at the State University of New York at Binghampton. June's parents were very proud, especially since she was the first person from her Vicksburg neighborhood to fly in an airplane.

June Rooks had other college experiences that helped her grow into a self-sufficient adult. In the spring of her junior year she ran for "Miss Jackson State University." She had to manage her own campaign because she had very little money, but her fellow students supported her and she came in second out of a group of seven. Again her family and her home town were proud of their June. She received a gift from the university for the homecoming and, as a member of the Queen's Court, free admission to the football games.

In 1973 June received her B.S. degree, with a major in physics and a minor in mathematics. She then obtained a Graduate Dean's Fellowship at Southern Illinois University at Carbondale, to continue her studies in physics. She found her professors supportive and the courses exciting but difficult enough to keep her studying every night of the week. June also enjoyed her work in



JUNE M. ROOKS, B.S. (postpolio), a physicist at the Naval Weapons Center, China Lake, California, demonstrates a bombardier/navigator station in a cockpit simulator of the A6-E intruder aircraft to a computer science student. She analyzes and develops software for determination of aircraft position and performance.

the Physics Department as a teaching assistant, a job which helped to alleviate her continuing financial problems.

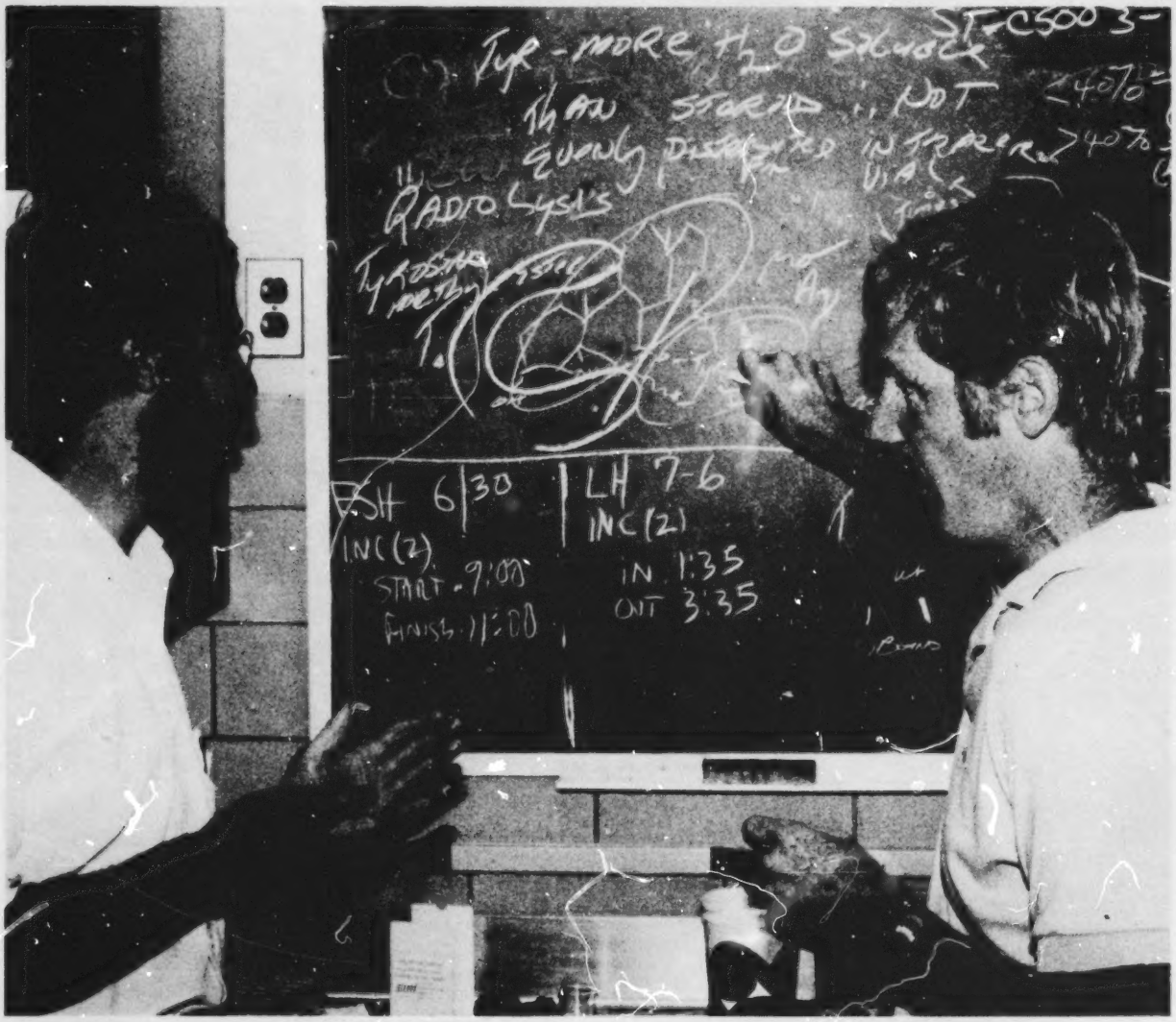
While she was at Southern Illinois University June Rooks spent two summers at the Fermi Laboratory in Batavia, Illinois, and another two summers with 3M Company in St. Paul, Minnesota. She has now completed the course work required for the M.S. degree and expects to complete her thesis in the summer of 1984.

Rooks has published several reports on her work since coming to the Naval Weapons Center in California over five years ago. In 1982 she was nominated for an award as Outstanding Handicapped Federal Employee of the Year.

She was recently selected by the National Science Foundation as a member of a panel to review projects in the program for Science and Technology to Aid the Handicapped, was the American Physical Society role model for junior and high school girls, and participated in the "Women in Science" videotape series produced by Educational Resources, University of Michigan at Ann Arbor. On a number of occasions she has spoken in support of educational needs in science for students with disabilities. She is a member of Sigma Xi, of the Society of Black Scientists, and of the Maturango Museum.

June is especially grateful for the guidance and support of her parents. She will never forget the principles by which they lived and their special efforts to see that their daughter received an education. Although neither of her parents are now living, she says that what they stood for in life and what they taught her will live with her forever.

RICHARD S. SKYER, JR., B.S.
BIOLOGICAL RESEARCHER, EDUCATOR OF DEAF



RICHARD S. SKYER, Jr., M.S. (deaf), shown at right, discusses radioimmunoassay procedures with his supervisor. They are using manual sign language and oral speech reading.

RICHARD S. SKYER, Jr., has a B.S. degree in biology and an M.S. in deaf education. He is employed as a laboratory technician in the Urology Research Department at the University of Rochester, Rochester, New York. In this position, he performs radioimmunoassays, atomic absorption spectroscopy, and statistical analyses of his own data and those obtained in various other parts of the Department's research program.

While he was still a student, Rick spent two summers in the Division of Biological and Medical Research at Argonne National Laboratory in Illinois, learning electron microscopic techniques and studying some of the effects of gamma radiations in mice.

Rick became totally deaf at age 20, as a result of benign tumors on the auditory nerves. After recovering from the neurosurgical removal of his tumors, he entered the National Technical Institute for the Deaf in Rochester, N.Y. There he learned sign language as well as speech reading, a total communication approach. Interpreters were available at the Rochester Institute of Technology also, from which Rick obtained the B.S. degree.

Although interpreters were provided as needed at the Rochester Institute of Technology, some lab instructors also were fluent in sign language. Rick considers the support services available there to have been an important factor in establishing his confidence about a scientific career.

After graduation from the Rochester Institute of Technology, he went to Western Maryland College where he obtained the M.S. degree in deaf education. Although Rick's principal interest is in biology, he found it was easier to obtain Vocational Rehabilitation support for graduate study in education than in biology.

During his precollege years before he became deaf, Skyer was much more interested in laboratory biology than in extensive reading and math. Only later did he learn that books and numbers are inseparable parts of all the sciences. In his early college courses he found general anatomy and physiology most exciting, while he now is more interested in the principles and investigative methods involved in radioimmunoassay and in the use of available computer systems.

In addition to his job, Skyer is also enrolled in an M.S. degree program in computer systems at Rochester Institute of Technology. Eventually he would like to combine technical skills with development of computer systems needed for laboratory technology.

In coping with his disability, Skyer appreciates the efforts of his associates to learn some sign language to facilitate communications. He feels fortunate to have a young and open-minded supervisor who does not let his biases keep him from giving a disabled person a chance to show his/her capabilities. Even now, more than seven years after becoming deaf, Rick realizes he has by no means conquered his disability and continues to work on his communication skills.

JAMES A. HENRY, B.A.
SYSTEMS ANALYST

JAMES A. HENRY, B.A. (cerebral palsy), uses a computer terminal for programming, a part of his routine daily activities as a systems analyst for the Medical Computer Services at the University of Cincinnati.

JAMES A. HENRY (B.A.) is a systems analyst for the Medical Computer Services at the University of Cincinnati, which provides computer support to research projects at the Medical School. Jim graduated from the University of Cincinnati almost twenty years ago, with a B.A. in mathematics and several courses in computer programming, after his strong early interest in meteorology had been turned aside.

Soon after Jim Henry was born, his parents learned that he had cerebral palsy, that it could not be cured, and that they would have to work out ways of coping. Jim attended a special elementary school for handicapped children in the Cincinnati public school system, where there was more emphasis on rehabilitation than education. Fortunately, there were some units on science each year to whet his natural inclinations, and he developed an early interest in math and the weather. In seventh grade there was a unit on weather forecasting, and right then he knew he wanted to become a meteorologist.

After eighth grade, Jim attended a regular public high school where he surprised everyone by finishing in four years and graduating cum laude. Science related courses included general science, physics, and four years of mathematics.

His sophomore year was a major turning point for Jim. When he tried to drop geometry because he could not draw triangles the math department head explained in detail that they were not really interested in whether he could or not. That afternoon Jim gained a greater appreciation of what mathematics is all about.

Nevertheless Jim still wanted to be a meteorologist. He had his own weather station and had read every book in the library on the subject. In his junior year, however, his counselor convinced his parents and then Jim that he could not be a meteorologist. After all a meteorologist's main duties are to draw maps and appear on television, explained the counselor, and since Jim could do neither, he would have to drop this career option. Although Jim was able to switch from meteorology to mathematics without too much difficulty, he was upset that he had been forced to change career plans for such invalid reasons.

In his efforts to select a suitable college Jim again encountered opposition. The counselor at the University of Illinois wanted Jim to forget science and math and to major in social studies, thereby ruling out this architecturally accessible school. As Jim expressed his response to this advice, ". . . I might be convinced to switch from meteorology to mathematics, but nobody was going to talk me into taking social studies."

Jim then decided to stay home and attend the University of Cincinnati. After five uneventful years which were more an extension of high school than a different experience, he graduated with the B.A. degree in mathematics.

Jim Henry then focused his job search on data centers in the greater Cincinnati area, but he was turned down again and again because he lacked experience. After nine months of searching, he was accepted in a computer training program at the University of Cincinnati Medical School. This led to a job at Medcomp Research Corp., which was staffed with disabled programmers and did contract programming. Jim worked here for four years, then was laid off because of lack of business.

Jim next accepted a position as a programmer with a suburban bank — not just the job he wanted, but interesting enough and he stayed for almost five years. Now an experienced programmer, he joined the programming staff at the University of Cincinnati where he was assigned to several groups before beginning his present position with the Medical Computer Services. Here he uses a terminal to program, but in the past he has used cards for a variety of programs. For all his written work he uses a selectric typewriter.

TEDDY L. BARBER, M.S.
OPTICAL AND ATMOSPHERIC PHYSICIST

TEDDY L. BARBER, M.S. (legally blind), a physicist at the White Sands Missile Range in New Mexico, processes scientific data through a large-screen computer terminal. This terminal can produce graphic materials for additional calculations and is capable of automatic print in letters up to three inches high.

TEDDY L. BARBER (M.S.) is a journeyman physicist, GS-12 grade level, in the Atmospheric Sciences Laboratory at the White Sands Missile Range in New Mexico, where he has worked for nearly 25 years. He is engaged in basic research in remote atmospheric sensing technology, using lasers of different wavelengths to determine properties of the atmospheric aerosol.

Barber, who is legally blind, has adapted high resolution television as well as various magnifying devices to enhance his vision. He recently developed techniques for using the Kurzweil Reading Machine together with the Univac 1108 Scientific Computer and a 4016-1 Tektronix terminal. The Tektronix has a cathode ray tube with 25-inch display screen and can be programmed to display 3/4-inch letters that he can read without additional aids.

In his early years, Teddy was intensely curious and developed an investigative approach to various scientific matters. At the age of 16, however, while planting wheat on his uncle's farm, he ate some wheat seed that had been treated with mercuric chloride. Within a week he had lost over 95% of his vision. As he adjusted to his visual loss, he learned to use his hearing more effectively and to be more discriminating in his smell and touch.

Teddy soon returned to his regular high school, and after graduation went on to Oregon State College at Corvallis, where he majored in optical and atmospheric physics. He found magnifying glasses helpful for the closer work required in his college studies. After receiving his B.S. degree, Teddy spent about a year searching for a job before he was hired as a GS-5 physicist in the Atmospheric Sciences Laboratory, where he has continued to the present time.

After coming to work at White Sands, Barber enrolled in an M.S. degree program in physical chemistry at New Mexico State University. The subject of his thesis, "Short Time Mass Variations in Natural Atmospheric Dust," is directly related to his work. He credits his wife's help in reading to him as a major factor in his getting through the required courses.

When Barber decided to become a physicist, some people suggested that a scientific career would be very difficult with his limited vision and advised him instead to become a laboratory technician. Barber has never regretted that he completely disregarded this advice.

Throughout his career Barber has been a determined scientist with a persistent drive to complete tasks that come along. He has developed a memory system for locating items and filing papers, in order to reduce the need to depend on reading labels and locating them by visual recognition. He believes that team work is especially important in his relations with co-workers, and that positive thinking, a bit of ingenuity, and a lot of persistence have played important roles in his professional success.

In 1981, Barber received an award as "Outstanding Handicapped Federal Employee of the Year," and was honored at a reception in Washington, D.C. His citation included recognition of his community service through scouting and assistance to other disabled people.

Barber has been scoutmaster for more than 18 years, and usually spends two days each month camping out with his troop in the wilderness areas in New Mexico. He has included students from the New Mexico School for the Visually Handicapped, Alamogordo, New Mexico, in hikes and various projects in which his sighted troop participated. His contributions to the Boy Scouts have been recognized with two special awards, the Silver Beaver award and the Virgil Order of the Arrow. Barber has also received an honorary lifetime membership in the New Mexico State PTA for his work with the Boy Scouts, and for sharing his scientific knowledge through equipment demonstrations in the Las Cruces public school system.

KAREN M. JACARUSO, B.S.
BIOLOGIST, EDUCATOR OF DEAF

KAREN M. JACARUSO, B.S. (hearing impaired), demonstrates the Coulter Counter Model S Ultra Flo 100 Platelet Counter, which she is using for peripheral blood studies on dogs. (Photo by H.V. Rhude)

KAREN M. JACARUSO (B.S.) became fascinated with biology in seventh grade when her class studied physiological processes such as circulation and respiration in the human body. For as long as she can remember she has enjoyed animals, and one of her early career goals was to become a veterinarian. Karen took college courses such as animal surgery, comparative vertebrate anatomy, and comparative animal physiology that increased her interests in the animal sciences even more.

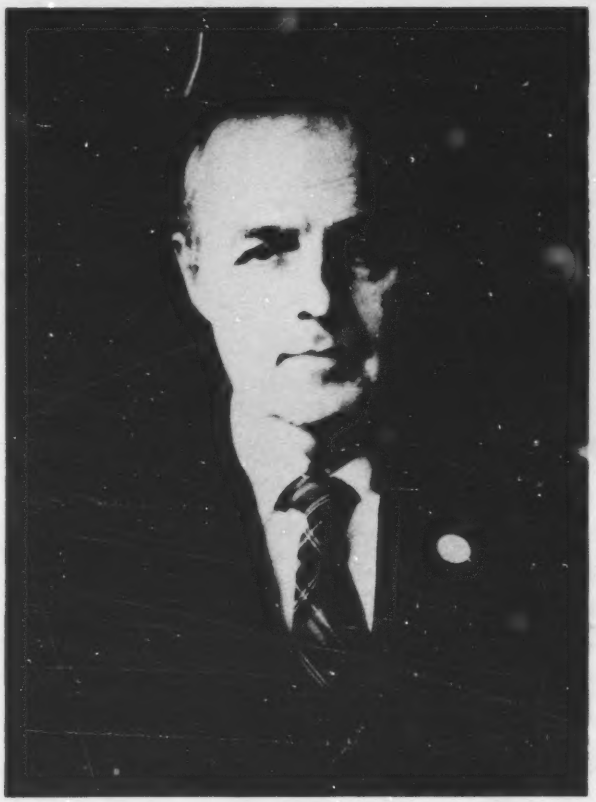
While she was an undergraduate student at the Rochester Institute of Technology, Karen spent one summer in a veterinary clinic in New York City, assisting in physiological evaluations of cardiac abnormalities in dogs, and another summer in the Division of Biological and Medical Research at Argonne National Laboratory in Illinois, where she carried out studies of peripheral blood in dogs.

Karen has been severely hearing impaired since birth. She recently graduated with a B.S. in biology from the Rochester Institute of Technology, Rochester, New York and is studying for the M.S. degree in deaf education at the University of Rochester. After graduating, she will be certified to teach biology, chemistry, and general science to hearing and deaf students at the secondary school level. Although her greatest interests are in the animal sciences, Karen believes that as a teacher she can be an effective role model for handicapped children, in encouraging them to work to achieve their goals.

Karen was a proficient speech reader at an early age. Her speech was so good that many people did not realize the extent of her deafness. Now, with her hearing aid and speech reading skills, she is well able to comprehend conversations in a one-to-one situation. She attended regular elementary and high schools, but studied very hard to maintain her high academic average. In college she had few problems doing lab work and managed the lecture material with the aid of notetakers. Karen explains that her notetakers also helped her decide about her science program. She believes she was fortunate in having parents as well as counselors who encouraged her to pursue her interests in biology.

In evaluating her disability, Karen says she had some difficulties with her studies in elementary and high school, but was able to overcome them by studying many hours every day. She was validictorian at her junior high school graduation, and in high school ranked sixth out of 502 in her graduating class. During these years, she feels fortunate to have had the support of school friends who understood her handicap and accepted her in their group activities. In college at the Rochester Institute of Technology, she was comfortable with other hearing-impaired students. She also talked freely about deafness with hearing students in order to promote better understanding and mainstreaming on campus.

R. KENT JONES, B.S.
CIVIL ENGINEER



R. KENT JONES, B.S. (multiple sclerosis), a civil engineer with the Metropolitan Sanitary District of Greater Chicago, continues to supervise the activities of his section from his wheelchair.

R. KENT JONES (B.S.), a civil engineer, is employed at the Metropolitan Sanitary District of Greater Chicago. He is in charge of a group of seven engineers and a secretary, and has responsibility for review of the plans for local sewers that are submitted by surrounding suburban communities. He is also a member of the Metrication Committee of the Water Pollution Control Federation. In addition, Jones is actively involved in promoting Esperanto as a universal international language and is the leader of an international committee that is translating a chemistry textbook into Esperanto.

Jones became interested in science during high school where he took a physics course and also participated in the meteorology club. He read extensively during this time and arrived at a decision to enter science largely on his own.

Now 51 years old, Jones has had multiple sclerosis for six years, and has used a wheelchair for about a year. Because he became disabled only after his education was completed and he was established as an engineer, he did not encounter the array of barriers frequently faced by students disabled in early years. He believes it is important to point out, however, that his present disability has not interfered significantly with the activities he is required to perform in carrying out his job.

There is a significant message in Jones's experiences for the disabled student interested in a career in engineering. In this broad field there are many important jobs where the requirements are more mental then physical. Jones points out that with the required educational background the physically handicapped student will be able to develop many ways to compensate for his disability and to function competitively. It is the sufficiently trained individuals who will be able to command positions at a high enough level so that they can rely on assistants to help carry out supportive manual tasks.

TODD A. BLUMENKOPF, B.S.
ORGANIC CHEMIST

TODD A. BLUMENKOPF (B.S.) is a fourth year graduate student at the University of California at Berkeley, where he is majoring in organic chemistry. His special interests are in natural product synthesis and his thesis research involves development of new methods for functionalized cyclopentanone annealation and investigations using organosilicon reagents. He is also working on the total synthesis of Fawcettimine, a naturally occurring Lycopodium alkaloid. After receiving his Ph.D. degree, he will begin a two-year postdoctoral research training position at the University of California at Irvine.

Todd's disability of spinal bifida necessitates use of a wheelchair. His parents encouraged his interests in science, he says, because they believed scientists would be more willing to accept handicapped persons than would professionals in the business world. Today, Todd is not so sure scientists are significantly more accepting of those who are different than are business administrators.

He attended regular public schools on Long Island and in Los Angeles, but only after his parents had overcome the opposition of school administrators. Todd believes that the reasons he was admitted to regular schools on Long Island were that the school district was relatively small, the administration was relatively open minded on this matter, and the schools were all on one level.

The family moved to Los Angeles when Todd was 14 and in the ninth grade. Again he became the first wheelchair student to attend a regular public school in the district, and again Todd's parents had to overcome the opposition of school district administrators to his admission, despite his excellent record in the Long Island schools. At one point an official from the main office called Todd aside and asked "You'd really rather be with your own kind, wouldn't you?" Todd responded that he wanted very much to attend the regular high school, and was finally admitted. He wonders what would happen today if a school official were to ask that question of a black or hispanic student.

Todd recollects that his first experiences with science were in third grade. His interest in science continued in high school and he took an unusually wide range of science courses (biology, chemistry, physics, and physiology). After high school graduation, he entered the University of California at Los Angeles (UCLA) as a Regents undergraduate scholar. In an honors program he studied organosilicon chemistry and published a portion of this research.

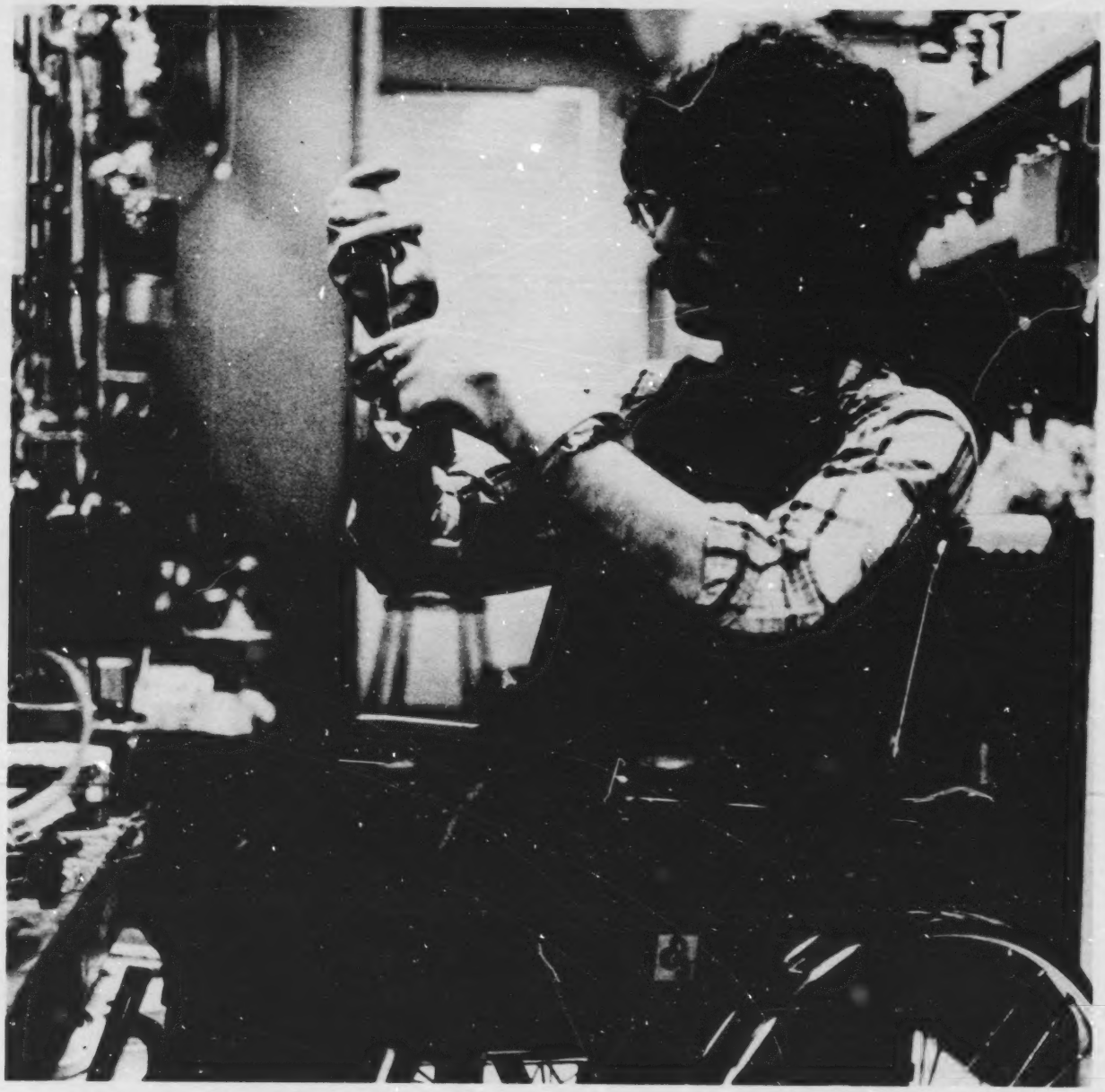
After graduation from UCLA, he entered the Department of Chemistry at the University of California, Berkeley, where he continued his investigations in organic chemistry. The list of laboratory equipment with which Blumenkopf has worked includes infrared spectrometers, analytical and preparative high-performance liquid chromatographs, diffusion pumps, and Fourier-transform nuclear magnetic resonance (NMR) spectrometers. In the laboratory, he uses the same work benches as non-disabled students, including a 22-inch high vacuum rack and a 36-inch high fume hood.

While he routinely carries out lab work from his wheelchair, he does use a wooden chair on casters, six inches higher than a normal wheelchair, when working with equipment such as NMR spectrometers that cannot accommodate the ferromagnetic characteristic of the ordinary steel wheelchair.

Todd has served four quarters as a teaching assistant at Berkeley, including assignments as undergraduate laboratory instructor and supervisor. He also served as a teaching assistant in a first-year graduate course in organic synthesis, and gave several lectures to the class from his higher wooden chair on casters. He finds this chair especially convenient when lecturing at a blackboard.

Even the most skeptical persons eventually come to accept Todd's abilities to work independently in the chemistry lab, he reports, but this acceptance is sometimes unduly delayed. In coping with such doubts he finds that patience is usually helpful. He believes, however, that disabled persons must challenge the unnecessary restrictions frequently imposed by those in decision-making positions and also help to increase the general awareness of the real significance of a physical limitation. Disabled persons must also take positive action on their own behalf in order to obtain opportunities for those meaningful careers for which they are qualified.

Todd is still somewhat undecided about his career plans once he has received the Ph.D. degree. After completing his postdoctoral appointment at the University of California at Irvine, he hopes to find an academic position with opportunities for both teaching and research. Meanwhile, he is an active member of the American Chemical Society, where he is helping to increase awareness of the capabilities of both scientists and students who happen to be disabled.



TODD A. BLUMENKOPF, B.S. (spinal bifida), is a Ph.D. candidate majoring in organic chemistry at the University of California at Berkeley. In the laboratory he uses the same work benches and equipment as nondisabled students, including a 22-inch high vacuum rack and a 36-inch high fume hood, and routinely does lab work from his wheelchair.

MARIA DOLORES CIMINI, B.A.
CLINICAL PSYCHOLOGIST

MARIA DOLORES CIMINI (B.A.) is in her fourth year of graduate study for the Ph.D. degree in clinical psychology at the State University of New York at Albany. She holds a B.A. from Barnard College, Columbia University, with honors in her major field and election to Phi Beta Kappa. In addition, she has been employed in various mental health and human services settings during the past several years.

Although Dolores has congenital glaucoma in both eyes, this condition did not limit her elementary and early high school studies. Before her vision began to deteriorate when she was 16, she was able to participate fully in science and math courses. She does recall that some limitation was suggested by statements such as "Dolores cannot see as well as everyone else, but she can do her work just as well." This early supportive attitude and learning environment provided positive academic experiences.

As Dolores's sight began to fail, however, her teachers and counselors assumed more negative attitudes about her abilities and she was discouraged from taking visually oriented mathematics courses. She found herself under severe emotional stress in trying to consider and implement solutions to the multitude of problems brought on by her increasing visual limitations. She had first become interested in science, especially mental health, during early high school years. When her sight deteriorated and she was no longer encouraged to pursue these interests, she decided to take more math and science anyway. But it seemed as though the teachers believed she could not be expected to achieve anything of significance in the future and they gave her little or no assistance in these courses.

MARIA DOLORES CIMINI, B.A. (congenital glaucoma), is a Ph.D. candidate in clinical psychology at the State University of New York at Albany.

In college her professors, especially one who was particularly supportive, provided Dolores with encouragement to pursue a career in psychology. A strong support network became an integral part of her personal and professional development, and she soon realized that, with the aid of adaptations and supportive instructors, she could accomplish more than she had been led to expect in high school. For example, she participated fully in a laboratory course in experimental psychology either by addition of an auditory transfer of information or by transcription of materials into large print. She also administered and scored personality tests and completed item analyses with the aid of a reader.

After investigations of modifications developed by other disabled persons, she utilized adaptations to help her perform as a more effective diagnostician. In administering psychological tests Dolores uses large print and braille. She hand writes the responses and dictates necessary information to a reader so the responses can be scored in the usual way. She realizes that thorough understanding of the performance sections of psychological tests is especially important in evaluating the client's responses, and she has memorized many parts of the tests. Some parts of standard tests may be adjusted for her use, but for those that cannot be adjusted, certain substitutions can be made or the part can be performed by a sighted psychologist.

As an undergraduate student, Dolores concentrated on adaptations she would have to make to carry on the diagnostic duties of a clinical psychologist. As a graduate student, she has given special attention to the impact of her disability on the psychotherapeutic process. Although she has found no differences in patient acceptance of blind and sighted therapists, she reports that some studies show clients tend to prefer psychotherapists who are disabled because they feel there will be a greater sensitivity to their problems. Then too, the blind psychotherapist is not influenced by the appearance of the client.

Dolores believes that perserverance and innovativeness have been important in helping her to succeed in her chosen scientific field and also to cope with her blindness. It was the challenges associated with clinical psychology that stimulated her interest in this field. She is especially interested in psychological testing and research in the area of disability, and would also like to teach at the college level after she has earned her doctoral degree. Perhaps most important, Dolores Cimini has come to consider herself a competent professional rather than a disabled psychologist.

LAWRENCE G. HORKEY, A.A.
ENGINEERING DESIGNER

LAWRENCE G. HORKEY, A.A. (deaf), is an engineering designer at Argonne National Laboratory. In his work he communicates by writing and gesturing, while to his deaf wife and others who understand he uses manual signing. (Photo by H.V. Rhude)

LAWRENCE G. HORKEY (A.A.) has been employed in the Engineering Division at Argonnne National Laboratory in Illinois since 1957. He began as a draftsman, and later was promoted to Engineering Designer. Horkey has been totally deaf since age six as a result of spinal meningitis. He communicates with the hearing world by writing and gesturing, while to his deaf wife, his son and family (hearing), and to friends he uses manual signing.

For his elementary and high school education, Horkey attended a residential school for the deaf. His science experiences in high school included biology, physics, mathematics, landscape architecture, and mechanical drafting.

After graduation, Horkey enrolled in a junior college program in mechanical drafting, when he could not find employment in either drafting or landscape architecture. There was no special program for the deaf in his local junior college and he communicated by writing and gesturing. After obtaining an Associate of Arts degree, he was finally successful in finding a drafting position. He worked for several companies before coming to Argonne.

An active man, Horkey built his own home, doing all the work except the bricklaying. His hobbies include woodworking, gardening, and fishing, and he enjoys reading, especially about developing technologies. He is also involved in the deaf community as a member of the International Catholic Deaf Association, and is editor of their monthly newspaper, GUIDON.

Although he has always enjoyed his work, he looks forward to early retirement. Then he will move to northern Wisconsin and fish for muskies whenever he feels like it.

MARTHA A. BURKS
STUDENT OF COMPUTER SCIENCE

MARTHA A. BURKS will soon receive the B.S. degree in computer science from Wright State University, Dayton, Ohio. Her scientific interests go back as far as she can remember, as she examined, wondered at, sometimes even handled rocks, living things, mechanical objects, and also gazed at the stars. She was especially interested in how things worked.

Martha was born with athethoid cerebral palsy, but for a time did not realize she was handicapped. When she needed something to help her do a certain task, her father's creativity would start flowing, tools and wood would appear, and as she watched, an adaptation took shape. Her father made her first wheelchair, and Martha's usual mode of travel in those days was scooting her homemade chair with her legs. It was many years before she obtained her first power wheelchair.

Martha grew up in the Cincinnati area of Ohio. Kindergarten was easy and fun, but in first grade she was in a "segregated class" composed only of "C.P.'s," so that they would not upset the other handicapped children. In this class the students were expected to learn very little, and even trips to the school library were not allowed in order to spare the other students.

So it went for Martha through most of her elementary and high school years. There was little to challenge her as the teachers seemed to believe that what the students learned did not matter because they would not be doing anything with their lives anyway. This is only one of many examples Martha can cite that so frequently reflect society's viewpoint.

Bright spots in elementary school were her parents who were always there to prompt her to do a little more than she might have, and a wonderful seventh grade teacher who did not know he was supposed to expect less of this special class than other children. During this year, Martha learned about math and was even encouraged to pursue her scientific interests. She received a microscope for Christmas and also her first typewriter. Since she is not able to write, the typewriter became an essential tool for written communication.

High school was hardly more challenging than elementary school, and Martha graduated with a college preparatory background, no place to go, and three questions unanswered: (1) How does electricity work? (2) How does the stock market work? and (3) What am I to do now?

The University of Illinois, the only college the Burks knew that was architecturally accessible, denied admission. Ironically it would not accept so severely disabled a person as Martha appeared to be. There followed fifteen years, during which Martha learned about herself and tried to find a way to obtain a college education. She took an English composition course by correspondence, tried to be the next "great American novelist," got involved with a handicapped group, and became aware of politics and equal rights for the handicapped.

She became an activist, got a home-based job monitoring local radio stations for types of commercials, and started nagging the Bureau of Vocational Rehabilitation. By the time she had gone through three counselors, she knew how to play the game, told them what they wanted to hear, and kept reminding them of her needs. Martha was assigned a seventh counselor before she convinced the Bureau that they should help her prepare for admission to college.

A turning point in Martha's struggles for a higher education and greater independence came when her counselor arranged for her to be admitted to Ohio State University's rehabilitation center. Here she built up her self-esteem and evaluated possible career options. Considering the job market and the nature of her physical limitations, computer science was the first choice. She had always enjoyed math, liked logical answers, and this field was one in which the job market was favorable and was considered to be acceptable by the rehab agency. Martha was most interested in geology and astronomy, but rejected these areas because of the required field work, poor job prospects, and her weak background in chemistry.

During all these years of searching for direction toward a future career Martha, and apparently her counselors as well, lacked role models of any kind. Her eighth counselor introduced her to a young man as severely disabled as she was. He had a degree in math from the University of Cincinnati and has worked for 15 years as a computer programmer. "If he can do it, so can I," thought Martha.

At last she was admitted to Wright State University in Dayton, Ohio, fifteen years after graduating from high school. Classes in computer science were easy and physics, her first lab course, went well. But the labs were inaccessible in this most accessible of all universities,

MARTHA A. BURKS (cerebral palsy) will soon receive her B.S. degree in computer science from Wright State University in Dayton, Ohio.

and every lab class after the first had to be fought for. Little wonder there are few handicapped students in the hard sciences at Wright State, and Martha is one of very few severely disabled students in computer science in her school.

At the end of her sophomore year, Martha spent a summer as an Undergraduate Research Participant in the Applied Mathematics Division at Argonne National Laboratory in Illinois. In this learning experience she demonstrated both to herself and to others that she could work in a job setting. It also provided opportunities to see and talk with handicapped Argonne staff members who were working in other scientific fields, thereby reinforcing Martha's resolve that "If they can do it, so can I." These successful role models also demonstrated that they had jobs doing meaningful work and that her friend at the University of Cincinnati was not a lone example of an accidental happening.

Martha now sees her B.S. degree in computer science about to become a reality, and an independent, rewarding life as a "light at the end of the tunnel." She realizes that finding a job will not be easy, but hurdles in her path are hardly new to her. Her principal strategy for coping has been an attitude that there is always some way of doing a task. There are always alternatives no matter how hopeless a problem looks. She also recommends keeping an open mind and working to foster it in others.

As for those three questions left over from her high school graduation days? Yes, they have now been answered to Martha's satisfaction.

ROBERT A. REGAN, A.A.
MEDICAL TECHNOLOGIST

ROBERT A. REGAN (A.A.) had an interest in biology before he entered first grade. He recollects that he was probably most interested in physiology. He has a basic curiosity about how things work and a desire to experiment and test new hypotheses. Bob recently graduated from Triton College in River Forest, Illinois, with an Associate of Arts degree. He plans to go on for a B.S. degree in medical technology or a related biological science. His current science interests include hematology, toxicology, physiology, and chemistry.

When Bob Regan was in preschool and elementary classes, there were no programs for the learning disabled and he had to have outside help in order to understand material that was being presented. Bob's condition is described as a specific learning disability, involving auditory discrimination and perception. He also has epilepsy and mild cerebral palsy.

In college Bob relied on tape recorders, notetakers, tactile boards, tactile tracings, and sign language. He carries a pad of paper and pen at all times in order to record names, appointments, etc., as soon as he hears them. In listening to a lecture in a large, noisy auditorium, for example, it helps him to have a sign language interpreter available so he can see what is being said as well as hear it. In individual conversations he reads lips to some extent as an aid in understanding, for he sometimes hears near and distant sounds at about the same level.

Robert Regan now is employed full time as a Medical Laboratory Technician at Mary Thompson Hospital in Chicago, Illinois. He works in various departments, including hematology, blood banking, and serology. In addition, he works part time for a hematology specialist at the hospital, performing platelet function tests and other special hematology procedures.

Although his own experience is still somewhat limited, Regan realizes that there are few career opportunities in the health fields for those people who have some disability. He hopes to change this situation in any way he can. While at Triton College he was active in the disabled students' organization. He also participated in a number of special programs in his home town of Oak Park during the International Year of Disabled Persons.

ROBERT A. REGAN, A.A. (learning disabled), is a medical laboratory technologist at Mary Thompson Hospital in Chicago.

HERMAN H. M. MUI STUDENT OF ELECTRICAL ENGINEERING

HERMAN H. M. MUI (congenital encephalopathy) is a student in the electrical engineering program at Illinois Institute of Technology in Chicago, working toward his B.S. degree. He has had experience in solar and wind energy projects. (Photo by H.V. Rhude)

HERMAN H. M. MUI recalls that he became interested in putting together an electronics kit when he was in the fifth grade, after he had watched his brother assemble a radio. He learned to solder by disassembling and reassembling an old TV and radio. This was a difficult task because Herman has problems with muscle coordination in his hands. In high school he took as many science courses as possible and also participated in the science club.

At the Illinois Institute of Technology in Chicago, Herman is enrolled in an electrical engineering program leading to the B.S. degree. He is especially interested in the development and transmission of energy as well as in other areas of physics. He has been involved in solar and wind energy projects and hopes to go on for a Master's degree.

As a handicapped student in the field of engineering, Herman has to face both physical and psychological challenges. He has difficulties in fine motor coordination as a result of a congenital encephalopathy. His early success in developing some different techniques to carry out procedures in the engineering laboratory has helped Herman to overcome his fears.

Confidence to accept challenges came after he had achieved an understanding and acceptance of himself. He believes he also possesses the persistence to learn, as well as the willingness to try, and then to accept the responsibility of failure. The social and psychological barriers with which Herman also must deal include other people's fears. For these he tries to develop a basic trust and involve the help of supportive persons.

Herman finds much satisfaction from his accomplishments in the laboratory and strongly believes that handicapped children should be encouraged to consider some field of science as a career. Encouragement from teachers, friends, and family have been important in furthering Mui's science education program, as has been the understanding and support of his laboratory instructors.

CONCLUDING COMMENTARY

An interest in science frequently begins with the young child's natural curiosity. This early interest can be further stimulated when the child is exposed to experiences involving the experimental method, as applied to observations of natural phenomena. Such is the case in grade school science, an important time and place to encourage the interests of budding young scientists.

But disabled children frequently are excluded from science programs. This is particularly true in special or "segregated" elementary schools, and also is true for those disabled children enrolled in special programs within regular schools. In fact, many teachers so fear disabled students in a science laboratory that they refuse to allow such students to participate in lab activities of any kind.

In junior high school, again the disabled students have fewer opportunities for courses in science, engineering, and math than their ablebodied peers. Blind students probably have the most difficulty in obtaining permission to participate in science labs. Students in wheelchairs sometimes find these facilities inaccessible even within an "accessible" school, and also may have difficulty in obtaining permission to take a science course. For example, a student with cerebral palsy was required to participate only as an observer in a high school science lab. While in college, she literally had to fight for every lab course. This student now is about to graduate with the qualifications for a career in computer science.

It is not surprising, then, that even at an early age disabled students with special interests in science, math, and engineering are often at an academic disadvantage. Later, when they are planning to enter college, they find they have not had the necessary prerequisite courses for the scientific major of their interest.

Those who became disabled as adults have the advantages of normal childhood experiences. However, they are faced with an array of somewhat different but no less challenging problems. Jobs may be lost, families may break up, and retraining for other jobs may become necessary.

The biographical profiles presented here demonstrate some of the characteristics that have enabled severely disabled persons to achieve their scientific and career success. Among the characteristics that emerge into a repeating pattern are motivation, lots of persistence, patience, ingenuity, assertiveness, and the ability to devise innovative approaches to potential problems.

Other helpful attributes include a high self-esteem, a sense of humor, and a mind open to alternative strategies. In order to compete with nondisabled persons, whether in the class room or in the work place, it is generally agreed that the disabled individual must be better prepared, must work harder, and make no excuses for poor performances.

In deciding on a career direction, many successful disabled persons took advantage of opportunities as they arose rather than working toward a preset goal wth a single minded purpose, as nondisabled students can do more readily. Others found it advantageous, or even necessary, to combine an area of special interest with one that would make them eligible for support from a vocational rehabilitation agency.

A factor important in achieving career success is strong family support, by spouse and/or parents, in providing encouragement and direction for educational programs. Encouragement and support by teachers can be extremely helpful, but unfortunately seem to be the exception rather than the rule. The support of graduate professors, in particular, usually is essential in obtaining a graduate degree. Role models also can be important in providing guidance, direction, and encouragement for the disabled student who faces many uncertainties but may have had little opportunity to build self-confidence. Negative factors contributing to a low level of self-worth occur much more often in the life experiences of disabled than nondisabled individuals. They commonly include the low expectations of teachers, counselors, and even parents.

Initially, the disabled child must demonstrate exceptionally high abilities in order to gain recognition and cooperation, especially from teachers. Because of their lower expectations of the disabled child's potential, teachers are less likely to provide the same encouragement or offer the same exposure to enrichment progams that are routinely available to nondisabled children. The disabled individual may be segregated even within the regular classroom, as when he or she is excluded from some activity; such practices reduce peer interactions and development of social skills. Later the disabled student may be exposed to a continuing stream of negative responses: one cannot be a mechanical engineer if one walks with braces and crutches, cannot teach if one is blind, cannot be a doctor if one is deaf, and so on and on.

Acceptance for graduate study has been questioned or even denied because some professors believe disabled

students completing their education will not find jobs. This belief is widespread and has broad consequences for academic admissions policies in many fields.

Many who are scientists today recall having been advised to ". . . become a draftsman," or ". . . become a technician," or ". . . give up plans for graduate study because it is too difficult." The most common advice given to disabled students is to go into the rehabilitation field or social studies. In the job search process, common remarks include ". . . can't do . . . if you're deaf," ". . . can't do . . . from a wheelchair."

Those disabled from early years who succeeded in school and went on to establish a career in science, math, or engineering demonstrated a strong early interest. This is especially noteworthy considering the relatively few opportunities available to these students to learn even basic information of what science is all about.

For many, an extra amount of determination and assertiveness was required to overcome the wide array of obstacles presented by teachers, counselors, school administrators, family, and friends. Sometimes even parents, who most of all want to provide every possible opportunity for their disabled child, share these low expectations. It has been demonstrated again and again, however, that supportive, assertive parents can help to provide the important influence needed to see that maximum opportunities are made available to their disabled child, through the school system as well as from rehabilitation agencies.

In the narrow view so frequently taken by ablebodied members of society, the very presence of a disability represents a failure — the absence of abilities considered essential for achieving success, well-being, and happiness. The potential capabilities of disabled individuals to complete an education and become established in a career are thereby written off as impossible. In a broader perspective, however, disabled persons who complete an academic program and are hired to do a job despite their physical limitations are not failures in any sense, because they have overcome the barriers encountered in reaching their goals.

The disabled persons included in this book have overcome numerous barriers and have demonstrated abilities as able scientists and students of science. But there is even more. They have gained satisfaction in overcoming difficulties and in accomplishing tasks required to function in the larger society, and this satisfaction served as an additional motivating force in their reaching even higher levels of accomplishment.

Some who became disabled after, say, age 16 have commented on the positive effect of their disability on their career. John Gavin's career actually flourished after he became deaf at age 35. Richard Skyer noted that his motivation as a serious student increased greatly after he lost his hearing when he was 20. Edward Keller began preparing for a scientific career only after his bout with polio at age 19. Nansie Sharpless began thinking about a professional career in science only after she became deaf at age 14. Cynthia Dusel-Bacon found she was making greater use of her brain when, at age 32, she no longer had full use of her arms. With only minor modification of her activities after she lost her arms she was able to continue her career.

Applications of computer technology in development of assistive devices for scientists with disabilities will greatly enlarge the options for career choices. Research and development programs are in progress in a wide variety of areas to begin to meet the existing needs. Examples include programs in electrical and optical communications, automation, bioengineering, and sensing systems. Research is in progress, for example, in materials for improved tactile, ultrasonic, and laser sensors, while artificial intelligence techniques are being developed for synthetic speech and character recognition for the nonvocal as well as the blind. The list goes on and on, and the possibilities become ever more exciting.

This book contains only a few examples of the variety of careers in which people with different disabilities are engaged. But our time and resources are limited, and we can hope to offer the reader only this sample of the seemingly limitless array of existing combinations of career and disability. This book does offer a fascinating glimpse of the possibilities and strongly suggests that almost nothing is impossible. After all, let us not forget the bumblebee.

SELECTED RESOURCES

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE (AAAS)

Project on the Handicapped in Science
Office of Opportunities in Science
1776 Massachusetts Avenue, N.W.
Washington, D.C. 20036

Phone: 202/467-4497
Martha Ross Redden, Ph.D., Project Director

Project on the Handicapped is a major resource for sources of information on science education for physically disabled students.
Newsletter includes various lists: computerized information sources, technology briefs about new devices, selected publications about aids and devices, and publications about issues in education.

AMERICAN CHEMICAL SOCIETY
Committee on the Handicapped
1155 16th Street, N.W.
Washington, D.C. 20036

Phone: 202/872-4600
Thomas Kucera, Ph.D., Chairman

Committee seeks to improve access to chemistry for disabled students.

AMERICAN FOUNDATION FOR THE BLIND
15 West 16th Street
New York, NY 10011

Information available on laboratory equipment and aids for use by blind and visually impaired.

ASSOCIATION OF HANDICAPPED STUDENTS SERVICES PROGRAMS IN POST-SECONDARY EDUCATION (AHSSPPE)
P.O. Box 21192
Columbus, OH 43221

Phone: 614/488-4972
Jane E. Jarrow, Executive Director

AHSSPPE is an association of rehabilitation professionals and others interested in improving services to disabled students on American college campuses.

LAWRENCE HALL OF SCIENCE
Centennial Drive
University of California
Berkeley, CA 94720

Phone: 415/642-3679
Herbert D. Thier, Ph.D., Associate Director

Hands-on science materials for multisensory science experiences are available for physically disabled children — Science Activities for the Visually Impaired (SAVI) and Science Enrichment for Learners with Physical Handicaps (SELPH).

NATIONAL SCIENCE TEACHERS ASSOCIATION (NSTA)
1742 Connecticut Avenue, N.W.
Washington, D.C. 20009

Phone: 202/328-5800

Provides resource information on teaching science to disabled students.

NATIONAL TECHNICAL INSTITUTE FOR THE DEAF
One Lomb Memorial Drive
Rochester, NY 14623

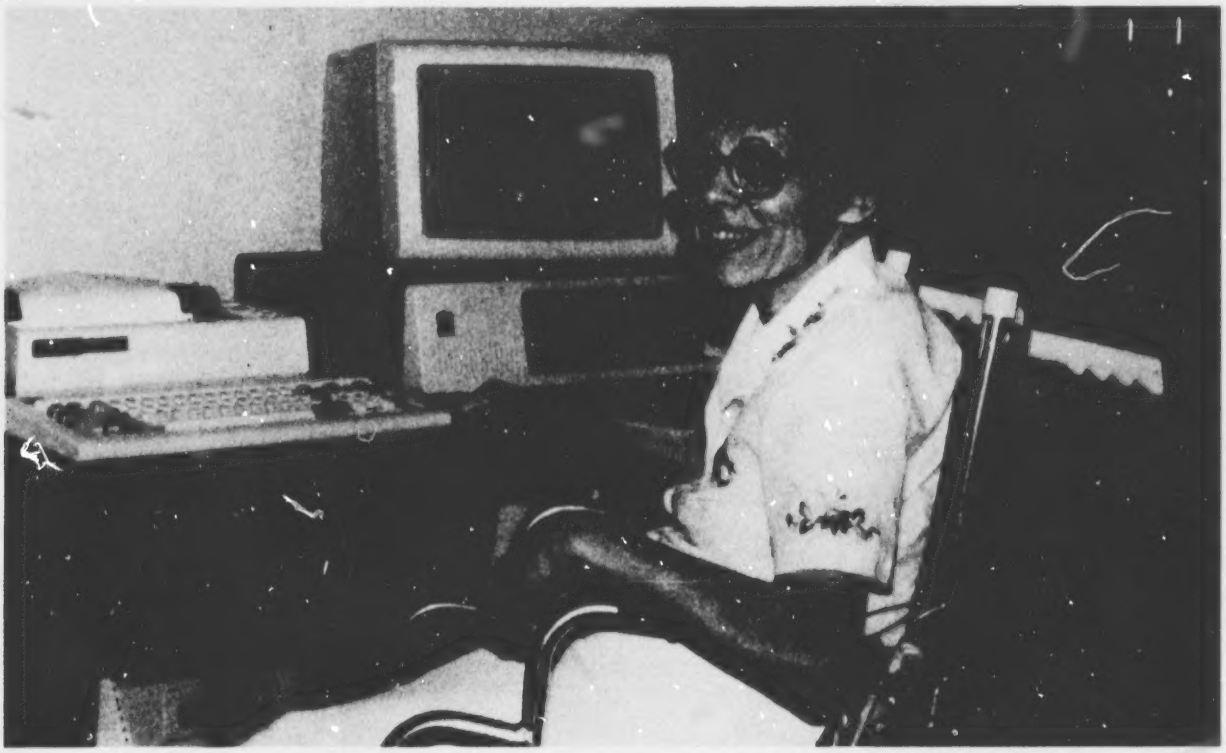
Serves as resource for other schools that teach deaf students in regular classes.
Material, available on request, describes training programs for interpreters, notetakers, and tutors of the deaf.
Special project is developing technical signs for terms in the sciences.
National Center on Employment of the Deaf is a resource for career matching, employment information, and referrals for hearing impaired post-secondary students and for employers.

SCIENCE FOR THE HANDICAPPED ASSOCIATION (SHA)
University of Wisconsin at Eau Claire
SSS 201
Eau Claire, WI 54701

Phone: 715/836-4164
Benjamin E. Thompson, Ph.D., Secretary-Treasurer

Publishes an extensive bibliography on science education for disabled students, as well as descriptions of current research on science teaching, conferences, and courses. Newsletter and bibliography available to members.

ABOUT THE AUTHOR



S. PHYLLIS STEARNER, Ph.D. (cerebral palsy), makes use of a microcomputer programmed for word processing in writing her book. (Photo by H.V. Rhude)

Dr. S. Phyllis Stearner, the author of this book and the moving force behind it, writes with a special understanding and sensitivity. She too is an able scientist, now retired, and a disabled person. As many of those she has profiled, she has experienced a life-long handicap, strong parental support, the sheltered world of the special school, the competitive environments of universities and the working world.

She has faced her own frustrations and obstacles, and the conscious and subconscious prejudices of nondisabled persons. In common with all those about whom she writes, she has motivation, persistence, flexibility, and she has also had the satisfaction of achievement in the stimulating field of science.

Phyllis is a soft-spoken person, whose outward appearance shows little of her inner determination, strength, and stubborn persistence. Her eyes sparkle with enthusiasm, easily infused into others. She looks forward to challenges, not back on past frustrations, physical setbacks, or on her considerable accomplishments.

Phyllis's early life and career were largely spent as a private person — learning, managing her disability, establishing herself as a respected scientist in the growing field of radiation biology. Her later years have increasingly been spent as an activist, educating the powers that be about the needs of the physically handicapped, and pushing for accessible buildings in the workplace and community. Since her retirement two years ago, she has been working in various ways to broaden the sights of physically disabled students, and those who counsel them, to the existence of careers in the sciences, and trying to open the minds of educators and employers to the potentials of students with disabilities.

Phyllis was born with cerebral palsy, the child of Scandinavian parents of modest means. Her mother remembered that Phyllis as a small girl had unusual interests in what doctors and dentists did. Later Phyllis drove her own car with no special aids. Her disability, however, has been somewhat progressive in later years as a result of osteoarthritis and spinal cord pressure in the neck region, for which she has undergone corrective surgery. She now walks only as a daily exercise, but whips around her home and western Chicago suburb in her motorized wheelchair.

Her parents engaged a private tutor to come to their home for Phyllis's elementary level education. There were no special classes for disabled students in their small Chicago suburb, and her father believed the occasional rough play of students in the regular school would be too hazardous for his only child. Her tutorial form of instruction provided experience in learning independently, which proved to be useful later, but Phyllis had little chance to play and study with other children.

High school education was principally at the Spalding School for the Handicapped in Chicago, which provided special advantages for the disabled student. But it was again a sheltered environment and the students, surrounded only by other handicapped children, developed a false sense of security.

Phyllis's parents had no higher academic education and were able to provide little guidance for a possible career. They did, however, provide important encouragement. Her mother was greatly concerned for her daughter's future and recognized that opportunities for employment and a useful life would require a good educational background.

As Phyllis entered her senior year in high school, she too became concerned about her future. Adulthood was fast approaching, her parents were aging, and there was little chance of lifetime support dropping down from the heavens. Then too, she wanted to learn about many subjects, especially in the sciences. She had read all the popular science books she could find in high school and, as she recently remarked, she believed at the time that a chance to participate in actual laboratory experiments in biology would be paradise on earth.

Counselors from the Illinois Division of Vocational Rehabilitation (DVR) directed most of the senior girls into short-term business programs and the boys into accounting or an electronic field. But Phyllis had a consuming interest in science. Reluctantly the DVR agreed to send her to one of the Chicago City Colleges where tuition and fees were minimal. After Phyllis successfully completed the two-year course and gained admission to the University of Chicago, the DVR approved her program and agreed to pay tuition and expenses for a bachelor's degree and eventually for a master's degree. When she had accomplished these milestones, they would not approve her continuing on for a Ph.D.

By then, however, Phyllis was committed to only one goal — to go on for the highest degree. Only with a doctorate did she feel she would have the educational requirements for an appropriate job, one she wanted and could carry out, and one that would allow her to be self-sufficient. With support from her family and a half-tuition service scholarship from the Zoology Department, she succeeded and in 1946 received her Ph.D. from the University of Chicago.

After graduation, she obtained a staff position in the Division of Biological and Medical Research at Argonne National Laboratory. There she established credentials as a radiobiologist. Among other achievements she became an acknowledged expert on the subtle effects of small amounts of radiation on the heart and blood vessels, those tissues basic to the health of all parts of the body. During her more than 35 years at Argonne, she authored more than fifty scientific papers and presented numerous talks at professional meetings, both in the U.S. and abroad.

Phyllis's enthusiasm, her sensitivity to the needs of the physically disabled, her persuasiveness, and her persistence were felt at Argonne. In large part through her activities (mostly gently prodding), washrooms were remodelled, elevator controls were marked in braille, a van was equipped with a wheelchair lift, interpreters for the deaf were provided for major lectures.

Through Argonne's Assembly on Equal Rights she pushed for more employment of the handicapped. She took an active part, with Robert Larsen who is profiled here, in a summer program for disabled students supported by the National Science Foundation. During the three years in which funds were available for this program, about fifteen disabled students took part in Argonne's Undergraduate Research Participation Program. The key role played by this program is well illustrated in three of the profiles in this collection.

On the national level, Phyllis Stearner was one of a small core of scientists with disabilities who organized and participated in several symposia at the annual meetings of the American Association for the Advancement of Science (AAAS). Some talks related to her own research and others to the concerns of disabled scientists.

Stearner sometimes participates as a member of the AAAS Resource Group of Handicapped Scientists in the program directed by Martha Ross Redden, who has provided the Foreword of this book. In the Foreword, Dr. Redden describes the program and gives the historical background leading to formation of the Foundation for Science and the Handicapped, Inc. in 1978.

From a sheltered little girl with cerebral palsy, Phyllis Stearner has come a long way, touching and enriching the lives of uncountable numbers en route.

—Marcia W. Rosenthal

INDEX OF PROFILED INDIVIDUALS

12 BALLANTYNE, Donald L.
42 BARBER, Teddy L.
46 BLUMENKOPF, Todd A.
50 BURKS, Martha A.

48 CIMINI, M. Dolores

8 DUSEL-BACON, Cynthia

17 FILPUS, Paul R.

6 GAVIN, John J.

40 HENRY, James A.
10 HOFFMAN, Herbert W.
49 HORKEY, Lawrence G.

44 JACARUSO, Karen M.
45 JONES, R. Kent

14 KELLER, Edward C., Jr.
24 KUSH, Richard W.

4 LARSEN, Joseph R.
26 LARSEN, Robert P.
34 LAUER, Harvey L.

32 MORGAN, Kirby L.
53 MUI, Herman H. M.

52 REGAN, Robert A.
36 ROOKS, June M.

18 SHARPLESS, Nansie S.
22 SHOTWELL, Odette L.
38 SKYER, Richard S., Jr.
30 SWANSON, Anne B.

20 WOS, Lawrence

FOUNDATION FOR SCIENCE AND THE HANDICAPPED, Inc.

THE FOUNDATION FOR SCIENCE AND THE HANDICAPPED, INC., is a nonprofit organization of scientists and professionals in various fields who offer their skills to help solve problems related to handicapped persons.

The overall goal of the FOUNDATION is to promote the complete integration of disabled scientists and students of science into all activities of the scientific community and of society as a whole. Scientists and nonscientists from a wide range of specialties, interested in the interface of science and disabled persons, have joined to expand and further educational and career objectives.

The FOUNDATION stresses the positive qualities of being handicapped. It is building a network that will support disabled scientists throughout their lives — a network that will provide information about who needs help and who can help.

THE BOARD OF DIRECTORS

Donald L. Ballantyne, Ph.D., President

David J. Vercelli, M.S., President-Elect

Nansie S. Sharpless, Ph.D., Past President

Edward C. Keller, Jr., Ph.D., Secretary

S. Phyllis Stearner, Ph.D., Treasurer

John J. Gavin, Ph.D.

Herbert W. Hoffman, M.S.

Martha R. Redden, Ph.D.

Requests for further information on FOUNDATION activities, and about membership, contributions, and participation may be directed to:

Dr. Edward C. Keller, Jr., Secretary
Foundation for Science and the Handicapped, Inc.
236 Grand Street
Morgantown, West Virginia 26505

Phone: (304) 293-5201